

# BALLISTIC MISSILE DEFENSE ORGANIZATION

**FY 1995  
Budget Estimates**

**February 1994**

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**- Editorial Note -**

**The numbering system shown on some pages of this book corresponds to the numbering system used within the FY 1995 budget book that was produced by the OSD Comptroller during February, 1994.**

**LETTER OF TRANSMITTAL**





DEPARTMENT OF DEFENSE  
BALLISTIC MISSILE DEFENSE ORGANIZATION  
7100 DEFENSE PENTAGON  
WASHINGTON, DC 20301-7100

DPF

January 21, 1994

MEMORANDUM FOR SECRETARY OF DEFENSE

SUBJECT: Ballistic Missile Defense Organization (BMDO) FY 1995 President's Budget (PB) - INFORMATION MEMORANDUM

This President's Budget submission reflects the fiscal requirements needed to accomplish the plan for Ballistic Missile Defense established in the Bottom Up Review (BUR). I believe the Administration and the Congress have largely agreed on missile defense goals--to defend forward-deployed and expeditionary elements of U.S. forces, as well as our friends and allies, against current and growing tactical or theater ballistic missile threats and continue technology development for defenses against foreseeable threats to the U.S. homeland.

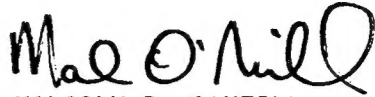
The resources are arranged to recognize Theater Missile Defense (TMD) programs as our number one priority and are aligned to develop near- and mid-term improvements in U.S. TMD capability as outlined by the Secretary during his release of the BUR results. The National Missile Defense (NMD) program is being pursued, within the bounds of fiscal guidance, as a technology readiness program to be able to provide for the defense of a future long-range ballistic missile threat against the U.S. homeland. The NMD program will emphasize risk reduction and the resolution of critical technical issues. FY 1994 is a transition year in which a number of current NMD contracts are either being restructured or terminated. This FY 1995 budget also provides for orderly restructuring of the infrastructure and support efforts so that adequate capabilities are retained for the TMD objectives and the revised NMD efforts.

The budget maintains an advanced technology research program, though at a level substantially below that of the past, against the uncertainty of the longer term threat. Also, the budget focuses on a logical and fruitful conclusion of the substantial investment made in several important experiments which provide important data to theater and strategic missile defense.

The efforts in the advanced technology area barely sustain the BMD program's ability to formulate the foundation for defensive systems that provide capabilities for countering potential future threats. The longer term potential threats may increase in number and sophistication.

The funds required for SBIR, IS&T, threat development/research, management oversight, and similar "overhead" activities represent the amounts required to support the BUR priorities and are comparable to those expended in FY 1993.

As directed by the Comptroller, DoD, BMDO has made significant changes to the Program Element (PE) and Budget Activity (BA) codes for BMDO's projects. In accordance with PB preparation requirements, attached are the Program Summary, Appropriation Summary, RDT&E Congressional Descriptive Summaries, Procurement and MILCON exhibits and other exhibits. Should you have further questions, please feel free to contact Mr. Billy Love or Mr. Robert Snyder at 693-1632.



MALCOLM R. O'NEILL  
Lieutenant General, USA  
Director

Attachments:  
As Stated

# PROGRAM OVERVIEW

Ballistic Missile Defense Organization  
FY 1995 President's Budget Submission

PROGRAM OVERVIEW

BACKGROUND

The Ballistic Missile Defense Organization (BMDO) is an outgrowth of the Strategic Defense Initiative Organization (SDIO) which was disestablished in early 1993. The Strategic Defense Initiative (SDI) was formed in 1983 as a broad-based, integrated research program to explore the feasibility of eliminating the threat of weapons of mass destruction delivered by ballistic missiles of all ranges. By 1987, ballistic missile defense (BMD) technologies and system and architecture concepts were developed sufficiently to permit the Joint Chiefs of Staff to issue a formal statement of mission objectives and required system characteristics for a Phase I BMD system, which were intended to deter, or if deterrence failed, disrupt a massive Soviet first strike on the U.S. Further, U.S. defense strategy called for an incremental and evolutionary growth in BMD capabilities.

With the dismantling of the Soviet Union and the end of the Cold War, the SDI was re-oriented toward regional conflicts and the growing threat caused by the proliferation of weapons of mass destruction and short-range ballistic missiles, and the threat from potential accidental or unauthorized limited attack on the U.S. arising out of the political instability among the states of the former Soviet Union. DoD's BMD approach to addressing the changing world conditions was embodied in a concept called Global Protection Against Limited Strikes (GPALS), which integrated theater and strategic defenses emphasizing global protection in addition to deterrence. GPALS defenses were intended to protect forward deployed U.S. forces, power projection forces, and other U.S. overseas interests against short-range ballistic missiles; and the U.S. against a long-range limited attack of up to 200 reentry vehicles.

THE CURRENT ENVIRONMENT

The 1991 Gulf War underscored the need for theater ballistic missile defense systems. The commitment to producing and deploying new systems remains strong within the Administration and Congress. However, U.S. intelligence assessments now have placed an extremely low probability on an unauthorized, accidental, or intentional long-range attack

on the U.S. The acquisition of a long-range ballistic missile capability by a potentially hostile third world nation, rather than the states of the former Soviet Union and People's Republic of China, is now viewed as the most serious long-range ballistic missile threat to the U.S. but is not expected to materialize in the near future. This environment served as the foundation for Secretary Aspin's Bottom-Up Review (BUR) of DoD's BMD requirements which has provided the primary guidance for the long term direction of the BMDO.

#### BMD AND THE BOTTOM-UP REVIEW (BUR)

As announced by Secretary Aspin during the BUR, U.S. BMD efforts will continue to pursue TMD as the number one priority, to include specific improvements to existing systems and development and deployment of new advanced capability systems. Additional TMD programs will be supported to provide future improvements to the systems.

In recognition of the low probability of a long-range ballistic missile attack from the former Soviet Union or China but to preserve a hedge against the acquisition or indigenous development of a long-range ballistic missile capability by another potentially hostile nation, National Missile Defense (NMD) efforts will be focused on achieving and maintaining technical readiness to move towards the formal system acquisition process. This will be accomplished by emphasizing risk reduction programs, key technologies, and activities to resolve critical technical issues. Brilliant Eyes (BE) will be continued as an acquisition program.

In recognition of changes in the nature of the ballistic missile threat and to provide for potential breakthroughs in BMD capability, advanced technologies will be supported at a lower level of effort than in previous years. Management and program infrastructure activities have been tailored to the revised BMD objectives.

Total BMDO funding for FY 1995-99 was announced at the time of the BUR as \$18 billion; with funding allocated to the TMD area at approximately \$12 billion; the NMD area at \$3 billion; including BE and BE support efforts, and follow-on technologies and research and support activities at a total of approximately \$3 billion. Since the announcement of the BUR, an OSD directive has removed \$1.1 billion from the FY 1995-99 BMDO program, resulting in a total FYDP funding of approximately \$17 billion, with the reduction being applied primarily to theater defense efforts.

#### THEATER MISSILE DEFENSE (TMD) PROGRAMS

Core TMD programs will consist of: an enhanced version of the PATRIOT air and missile defense system, PATRIOT Advanced Capability Level-3 (PAC-3); the sea-based AEGIS/Standard Missile Block IVA; and the land-based Theater High-Altitude Area Defense (THAAD) system, to include TMD Ground-Based Radar (GBR). Additional efforts will involve concept exploration activities for a potential sea-based Upper Tier, Corps SAM (which would provide defense for maneuvering ground forces), and a boost phase interceptor/EXO system with one of the concepts to be selected several years from now for further development.

**PAC-3** - The PAC-2 was used with some success against the modified Iraqi Scud missiles during the Gulf War. The immediacy of the tactical ballistic missile threat strongly supports the rapid deployment of the PAC-3 which will provide greater lethality, range and accuracy, and more capability against tactical ballistic missiles. PAC-3 would include an improved radar and either an upgraded PATRIOT missile or a new hit-to-kill interceptor missile.

**AEGIS/Standard Missile Block IVA** - The Navy currently deploys AEGIS cruisers and a growing number of destroyers equipped with the Standard missile for air defense operations. The Block IVA program will capitalize on this existing infrastructure by fielding upgraded Standard missiles and software improvements to the AEGIS radar to provide a sea-based TMD capability. In some circumstances, a naval TMD capability could be in place within a regional conflict area to provide TMD protection for land-based assets before hostilities erupt or before land-based defenses can be transported to the theater.

**Marine Corps TMD** - The Marine Corps Tactical Missile Defense (TMD) Initiative will provide a basic TMD capability for the Marine Corps to provide an interim point defense of vital assets in the amphibious operating area. This TMD capability will be accomplished through product improvements to the TPS-59 Radar and the Hawk missile system and through development of the Air Defense Communications Platform.

**THAAD** - While modifications to existing systems deal with many existing theater ballistic and cruise missile threats, the THAAD system allows multiple shot opportunities to intercept theater ballistic missile threats. Multiple shot opportunities, coupled with THAAD's longer range missile, allows threat carrying weapons of mass destruction to be neutralized at higher altitudes and longer ranges from the defended area than current generation defensive systems. When deployed with either a PAC-3 or AEGIS/SM2 Block IVA as a lower defensive tier, THAAD would represent the centerpiece of a highly effective integrated defense of critical areas.



**Theater Missile Defense Ground-Based Radar (TMD-GBR)** - The TMD-GBR meets an immediate requirement for a more capable wide-area-defense radar to provide surveillance and fire control support to the THAAD missile system and cueing support to lower tier systems such as PATRIOT. The TMD-GBR utilizes state-of-the-art radar technology to accomplish its required functions of threat attack early warning, threat type classification, interceptor fire control, external sensor cueing, and launch and impact point estimation. In particular TMD-GBR will be able to provide a capability to perform threat classification against theater tactical ballistic missiles, and then, kill assessment after intercept. In addition to providing fire control support for THAAD and cueing support to the lower tier, the TMD-GBR also will have a residual capability against air-breathing threats.

**Sea-Based Upper Tier** - All sea-based concepts for higher altitude missile (upper tier) intercepts take advantage of the Vertical Launch System on naval combatants and offer very long-range intercept potential against theater ballistic missile threats when supported by space based sensors or other over-the-horizon sensor. The sea-based systems, which could be among the first deployed TMD systems in a regional crisis, could provide extensive area protection.

**Corps SAM** - This new mobile air and missile defense system would protect Army or Marine maneuver forces against short-range ballistic missiles and advanced cruise missiles fired from any direction. In addition, Corps SAM would be more transportable and mobile and have more on-line missiles per battery than the PAC-3.

**Boost Phase Intercept/EXO** - Concepts which employ airborne systems for attack of missiles in either the boost or ascent phase, using either kinetic energy or directed energy kill mechanisms, offer the potential to destroy attacking missiles over enemy territory and would be effective particularly against certain types of warheads.

**TMD C<sup>3</sup>** - C<sup>3</sup> systems provide the framework for synchronizing and integrating TMD operations. TMD C<sup>3</sup> is considered an extension of the CINC's existing air defense command and control structure. The acquisition strategy is to take advantage of the large inventory of C<sup>3</sup> assets already available in the theater and maximize the use of existing command center and communications capabilities. This approach minimizes costs and provides an enhanced early combat capability. Some modifications will be required to account for the unique features of TMD. The primary focus will be on interoperability and the free exchange of improved warning and surveillance data.

**International Programs** - BMDO supports a cost sharing technology program with Israel which will lead to Israeli development of the Arrow TMD system. During the Gulf War, Israel was attacked by ballistic missiles. The need for a defense against this threat is urgent. With cooperation from the U.S., Israel is developing the Arrow system to counter this danger. This type of burden sharing also yields a valuable technology exchange for use in U.S. core TMD programs.

#### NMD PROGRAMS

The NMD acquisition program has been restructured into a technology readiness program. The readiness program for the NMD elements seeks to maintain the capability for contingency options to deploy defenses while increasing the capability of the individual elements in an orderly fashion. A series of Epochs, nominally three years each, will begin in FY 1995 to resolve critical issues in all of the NMD elements. The initial Epoch will provide the highest priority to improving the Exo-atmospheric Kinetic Kill Vehicle (EKKV) on the Ground-Based Interceptor (GBI). Depending on the technical progress and the emerging threat, program plans will be adjusted in subsequent Epochs. The BE program remains an acquisition program to maintain its potential as a "force multiplier" for TMD and for space surveillance in addition to its place in the NMD architecture.

**Space-Based Sensors/BE** - A constellation of BE missile tracking and discrimination satellites could provide the earliest data on ballistic threats. This "time" advantage acts as a "force multiplier" by supporting the maximum number of intercept opportunities against any ballistic threat. BE could provide an autonomous missile surveillance and tracking capability for a number of regions of TMD interest and can be cued by a national threat warning and attack assessment means to track ballistic missiles continuously after launch for TMD and NMD. The reduction in the BE budget forced an 18 month slip in the launch of the DEM/VAL satellites (until 1998) and a downselect between the two competing contractors. The slipped schedule will support the TMD schedule and the integrated NMD testing at the USAKA test range in a later phase of the NMD technology readiness program. The program risk associated with an early BE downselect will be reduced by the data that should be collected by the Midcourse Sensor Experiment.

**Ground-Based Interceptor (GBI)** - The GBI technology readiness program takes advantage of the previous BMDO work accomplished on the Exoatmospheric Reentry-vehicle Interceptor Subsystem (ERIS) programs, as well as on the Light Exoatmospheric Projectile (LEAP) and Space-Based Interceptor (SBI) programs. The most important GBI technical issue is the improvement of the engagement volume of the front end of the interceptor, called the



Exoatmospheric Kinetic Kill Vehicle (EKV). The larger the engagement volume becomes, the easier it is for the surveillance and tracking sensors to place the GBI in the position for a successful intercept. The components that most impact the EKV engagement volume are the on-board sensors and divert propulsion. The limited GBI budget forced a downselect of the three GBI-X contractors to two. The remaining two contractors will be preparing to flight test their brassboard sensors as a prelude to later EKV flights before the end of the first Epoch.

**Ground-Based Radar (GBR)** - The GBR technology readiness program will build on the solid state radar experience of the TMD-GBR (THAAD radar). The goal of the NMD-GBR is to prepare for integrated testing at USAKA with the GBI and space sensors in the early part of the next decade. The NMD-GBR contract with Raytheon was terminated. The remaining GBR technology work on the Solid State Array Demonstration and software improvements to support the tracking and discrimination of strategic ballistic missiles is reported under the TMD-GBR.

#### ADVANCED TECHNOLOGY

To maintain the vitality of a BMD architecture over time, technologies must be developed to provide options for improvements to planned and deployed defenses, giving them new capabilities to respond to a range of needs. Among the most important of these needs are (1) capabilities to meet potentially straightforward countermeasures (2) threat evolution along the lines of early release submunitions that complicate an effective defense, (3) potential proliferation of theater ballistic missile systems that may increase the needed responsiveness of defensive systems, and (4) affordability and sustainability improvements as users gain operational experience.

To prepare to meet these future needs, advanced technology programs will invest in high leverage technologies that yield capabilities across a focused array of kinetic energy weapon interceptors, advanced target sensors, directed energy interceptors, and innovative science. The high potential payoffs include (1) boost and ascent phase intercepts that assist in defeating tactics and warhead deployments designed to saturate midcourse and terminal tier defenses, (2) continuous coverage, to provide defensive capabilities against surprise attack or during the early stages of rapidly escalating conflicts, (3) exo- and endoatmospheric intercepts with a high probability of kill at lower cost thus expanding battle space, enlarging defended areas, and overcoming simple countermeasures, (4) multi-sensor detection and tracking that extends through the missile flight path, and (5) identification and discrimination that supports assured targeting.

#### SUMMARY

In summary, the BMD program is focusing on a balanced approach to obtaining needed capabilities for use by the warfighter as soon as prudently possible within affordability constraints. BMDO is providing TMD material for fielding now and throughout the '90's. BMDO will also maintain technological readiness for NMD and support future missile defense options to support other critical active defense missions. In this way BMDO ensures that active missile defense is retained as an essential insurance policy for counterproliferation.

## APPROPRIATION SUMMARY

U N C L A S S I F I E D

APPROPRIATION SUMMARY

A. (U) RESOURCES: (\$ In Thousands)

<u>Program Name:</u>	<u>FY1993</u> <u>Actual</u>	<u>FY1994</u> <u>Estimate</u>	<u>FY1995</u> <u>Estimate</u>	<u>FY1996</u> <u>Estimate</u>	<u>FY1997</u> <u>Estimate</u>	<u>FY1998</u> <u>Estimate</u>	<u>FY1999</u> <u>Estimate</u>	<u>Total</u> <u>Program</u>
<u>RDT&amp;E</u>								
0602217C (BMD-6.2)	120,210	73,053	106,460	106,774	113,820	116,521	114,773	Continuing
0603216C (TMD-6.3)	341,683	393,457	479,131	513,572	510,900	549,318	537,350	Continuing
0603217C (BMD 6.3)	2,052,780	829,301	769,993	743,463	732,145	740,610	742,458	Continuing
0603218C (BMD 6.6)	218,352	198,802	215,233	223,077	226,077	229,074	232,111	Continuing
0604216C (TMD-6.4)	685,375	1,080,490	1,071,283	986,143	347,083	202,460	285,922	Continuing
0604217C (BMD-6.4)	209,900	0	120,000	150,000	150,000	200,000	200,000	Continuing
0604225C (TMD-6.5)	0	42,097	217,755	231,576	705,636	925,471	770,785	Continuing
TOTAL RDT&E	3,628,300	2,617,200	2,979,855	2,954,605	2,785,661	2,963,454	2,883,399	
<u>PROCUREMENT</u>								
0208060C (TMD)	<u>75,200</u>	<u>120,719</u>	<u>273,390</u>	<u>452,040</u>	<u>507,630</u>	<u>704,010</u>	<u>1,089,920</u>	Continuing
TOTAL PROCUREMENT	75,200	120,719	273,390	452,040	507,630	704,010	1,089,920	
<u>MILCON</u>								
0603217C (BMD-6.3)	<u>2,500</u>	<u>2,727</u>	<u>530</u>	<u>2,992</u>	<u>2,082</u>	<u>2,725</u>	<u>2,325</u>	Continuing
TOTAL MILCON	2,500	2,727	530	2,992	2,082	2,725	2,325	
TOTAL	3,706,000	2,740,646	3,253,775	3,409,637	3,295,373	3,670,189	3,975,644	

U N C L A S S I F I E D

# PROGRAM ELEMENT SUMMARIES

U N C L A S S I F I E D

PE SUMMARY

Program Element: 0208060C  
PE Title: Theater Missile Defense (U)

Budget Activity: 01  
Major Equipment (U)

A. (U) RESOURCES: (\$ in Thousands)

<u>Project Number and Title:</u>	<u>FY1993 Actual</u>	<u>FY1994 Estimate</u>	<u>FY1995 Estimate</u>	<u>FY1996 Estimate</u>	<u>FY1997 Estimate</u>	<u>FY1998 Estimate</u>	<u>FY1999 Estimate</u>	<u>Total Program</u>
2104 GBR	0	0	0	0	0	15,424	189,289	3,720M
2207 Patriot	75,200	120,719	255,063	435,622	386,515	470,651	439,878	4,253M
2210 THAAD	0	0	0	0	0	0	317,361	8,268M
2213 Sea Based TMD Int	0	0	14,496	11,287	49,265	150,225	143,392	4,847M
2308 HAWK System BM/C3	0	0	3,831	5,131	20,530	0	0	Completed
3211 C4I & Concepts Ops Anal	0	0	0	0	51,320	67,710	0	Continuing
<b>TOTAL</b>	<b>75,200</b>	<b>120,719</b>	<b>273,390</b>	<b>452,040</b>	<b>507,630</b>	<b>704,010</b>	<b>1,089,920</b>	

B. (U) BRIEF DESCRIPTION OF ELEMENT:

(U) Includes manpower authorizations and the associated costs specifically identified and measurable to the following:

Procurement for programs, projects, and activities (including those formerly associated with the Tactical Missile Defense Initiative) that have as primary objectives either of the following:

- o The development of deployable and rapidly relocatable advanced theater missile defenses capable of defending forward-deployed and expeditionary elements of the Armed Forces of the United States, to be carried out with the objective of selecting and deploying more capable theater missile defense systems by the mid-1990s.
- o Cooperation with friendly and allied nations in the development of theater defenses against tactical or theater ballistic missiles.

U N C L A S S I F I E D

U N C L A S S I F I E D

PE SUMMARY

Program Element: 0602217C

PE Title: Ballistic Missile Defense (U)

Budget Activity: 02  
Exploratory Development (U)

A. (U) RESOURCES: (\$ In Thousands)

<u>Project Number and Title:</u>	<u>FY1993 Actual</u>	<u>FY1994 Estimate</u>	<u>FY1995 Estimate</u>	<u>FY1996 Estimate</u>	<u>FY1997 Estimate</u>	<u>FY1998 Estimate</u>	<u>FY1999 Estimate</u>	<u>Total Program</u>
1601 IS&T	80,048	41,510	60,000	60,000	60,000	60,000	60,000	Continuing
1602 SBIR	40,162	31,543	46,460	46,774	53,820	56,521	54,773	Continuing
<b>TOTAL</b>	<b>120,210</b>	<b>73,053</b>	<b>106,460</b>	<b>106,774</b>	<b>113,820</b>	<b>116,521</b>	<b>114,773</b>	

B. (U) BRIEF DESCRIPTION OF ELEMENT:

Programs, projects, and activities that have a primary objective to explore innovative science and engineering and Small Business Innovative Research for technologies of interest to a ballistic missile defense objective. Includes manpower authorizations and the associated costs specifically identified and measured to the performance of these programs.

U N C L A S S I F I E D

U N C L A S S I F I E D

PE SUMMARY

Program Element: 0603216C  
 PE Title: Theater Missile Defense (U)  
 Budget Activity: 03  
 Advanced Technology Development (U)

A. (U) RESOURCES: (\$ In Thousands)

<u>Project Number and Title:</u>	<u>FY1993 Actual</u>	<u>FY1994 Estimate</u>	<u>FY1995 Estimate</u>	<u>FY1996 Estimate</u>	<u>FY1997 Estimate</u>	<u>FY1998 Estimate</u>	<u>FY1999 Estimate</u>	<u>Total Program</u>
1105 Discrimination	11,360	4,000	58,119	52,014	47,014	56,014	43,514	Continuing
1106 Sens Stud & Exp	78,528	30,066	28,500	35,000	30,000	0	0	Continuing
1201 Int Comp Tech	0	8,000	5,000	5,000	0	0	0	Continuing
1206 Advanced Tmd Weapons	6,100	0	0	0	0	0	0	Completed
1215 Boost Phase Int / EXO	0	15,000	0	0	0	0	0	Continuing
1216 Sea-Based Wide Area	31,500	80,000	17,725	30,590	33,400	36,510	39,145	Continuing
1501 Survivability	3,120	3,024	4,900	3,800	3,800	3,800	3,700	Continuing
1502 Leth & Tgt Hard	26,320	29,064	32,800	29,400	28,200	25,300	15,800	Continuing
1504 Matls & Structure	0	800	0	0	0	0	0	Continuing
2209 ARROW/ACES	57,776	61,424	52,400	45,000	40,000	45,000	50,000	Continuing
2212 Corps SAM	22,000	20,000	17,725	30,590	33,400	36,510	39,145	Continuing
2213 Sea Based TMD Int	5,500	0	0	0	0	0	0	Continuing
2300 BM/C3 Technology	0	130	0	0	0	0	0	Continuing
3101 Engr/Integration Suppt	0	12,500	45,590	45,590	45,590	45,590	45,590	Continuing
3201 Architecture & Studies	32,605	26,675	42,161	48,361	51,980	59,138	51,281	Continuing
3202 Operations Interface	0	0	2,522	2,522	2,522	2,522	2,522	Continuing
3300 Test & Eval Support	62,552	91,748	163,855	167,900	169,682	203,882	208,582	Continuing
4000 Operational Support	4,322	11,026	7,834	17,805	25,312	35,052	38,071	Continuing
<b>TOTAL</b>	<b>341,683</b>	<b>393,457</b>	<b>479,131</b>	<b>513,572</b>	<b>510,900</b>	<b>549,318</b>	<b>537,350</b>	

U N C L A S S I F I E D



U N C L A S S I F I E D

PE SUMMARY

Program Element: 0603216C

PE Title: Theater Missile Defense (U)

Budget Activity: 03

Adv Tech Dev (U)

B. (U) BRIEF DESCRIPTION OF ELEMENT:

Theater Missile Defense programs, projects, and activities that have as a primary objective the development of technologies capable of supporting systems, components, and architectures that could produce highly effective defenses against theater missile threats. Includes manpower authorizations and the associated costs specifically identified and measured to the performance of these programs.

U N C L A S S I F I E D

U N C L A S S I F I E D

PE SUMMARY

Program Element: 0603217C  
 PE Title: Ballistic Missile Defense (U)  
 Budget Activity: 03  
 Advanced Technology Development (U)

A. (U) RESOURCES: (\$ In Thousands)

<u>Project Number and Title:</u>	<u>FY1993 Actual</u>	<u>FY1994 Estimate</u>	<u>FY1995 Estimate</u>	<u>FY1996 Estimate</u>	<u>FY1997 Estimate</u>	<u>FY1998 Estimate</u>	<u>FY1999 Estimate</u>	<u>Total Program</u>
1101 Passive Sensors	20,357	9,822	24,500	26,600	25,500	12,900	12,500	Continuing
1102 Radar	10,305	1,631	10,000	9,000	9,000	9,000	9,000	Continuing
1104 Signal Processing	18,410	6,914	7,100	12,000	13,500	7,000	5,000	Continuing
1105 Discrimination	84,712	54,404	29,382	14,986	10,986	8,986	15,986	Continuing
1106 Sens Stud & Exp	149,984	86,311	48,600	40,800	32,500	37,100	20,000	Continuing
1110 Sensor Integration	53,370	25,306	0	0	0	0	0	Completed
1111 Adv Sensor Tech	43,989	36,527	48,000	48,000	48,000	48,000	48,000	Continuing
1201 Int Comp Tech	17,735	11,726	22,500	28,500	26,900	30,500	33,500	Continuing
1202 Interceptor Int	136,336	0	0	0	0	0	0	Completed
1204 Interceptor Stud & Anal	7,500	6,115	0	0	0	0	0	Completed
1208 Discriminating Int	174	0	0	0	0	0	0	Completed
1209 Endo Tech	22,910	2,500	0	0	0	0	0	Completed
1212 D-2 Program	9,800	4,600	0	0	0	0	0	Completed
1214 Adv Interceptor Tech	207,279	15,000	0	0	0	0	0	Completed
1215 Boost Phase Int / EXO	15,435	16,489	61,100	65,300	70,300	85,300	90,300	Continuing
1217 KKV Technology	81,338	57,200	120,000	113,000	111,000	125,000	126,000	Continuing
1301 Radio Frequency FEL	14,232	0	0	0	0	0	0	Completed
1302 Chem Laser	69,164	54,269	77,500	77,500	77,500	77,500	77,500	Continuing
1303 NPB Tech	39,126	7,392	0	0	0	0	0	Completed
1305 ATP/FC Tech	21,067	6,492	12,500	12,500	12,500	12,500	12,500	Continuing
1307 DEW Demo	21,038	1,991	0	0	0	0	0	Continuing
1403 Computer Eng Tech	2,630	0	2,500	0	0	0	0	Completed
1405 Communications Eng Tech	12,205	1,932	500	0	0	0	0	Completed
1501 Survivability	25,367	3,321	3,000	3,000	4,000	2,000	3,000	Continuing

U N C L A S S I F I E D

U N C L A S S I F I E D

PE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Budget Activity: 03

Advanced Technology Development (U)

A. (U) RESOURCES: (\$ In Thousands)

<u>Project Number and Title:</u>	<u>FY1993 Actual</u>	<u>FY1994 Estimate</u>	<u>FY1995 Estimate</u>	<u>FY1996 Estimate</u>	<u>FY1997 Estimate</u>	<u>FY1998 Estimate</u>	<u>FY1999 Estimate</u>	<u>Total Program</u>
1502 Leth & Tgt Hard	10,776	1,358	0	0	1,000	1,800	2,000	Continuing
1503 Power & Power Condit	41,229	7,060	10,000	10,000	10,000	10,000	10,000	Continuing
1504 Matls & Structure	23,915	5,609	7,000	11,000	8,200	8,000	7,000	Continuing
1700 Flight Tst / Launch Act	63,048	42,996	0	0	0	0	0	Completed
2103 GSTS	11,500	0	0	0	0	0	0	Completed
2104 GBR	82,480	24,849	8,000	11,000	20,000	20,000	26,000	Continuing
2300 BM/C3 Technology	49,048	23,197	56,500	59,000	59,000	59,000	59,000	Continuing
3101 Engr/Integration Suppt	137,352	29,105	18,977	18,977	18,977	18,977	18,977	Continuing
3107 Envir Siting & Facil	5,130	5,606	5,606	5,606	5,606	5,606	5,606	Continuing
3201 Architecture & Studies	34,647	11,000	8,000	8,000	8,000	8,000	8,000	Continuing
3202 Operations Interface	8,041	4,373	1,530	1,530	1,530	1,530	1,530	Continuing
3203 Intel Threat Dev	13,987	8,050	8,050	8,050	8,050	8,050	8,050	Continuing
3204 Countermeasures Integ	16,916	16,303	18,303	18,303	18,303	18,303	18,303	Continuing
3206 System Threat	9,229	6,890	6,890	6,890	6,890	6,890	6,890	Continuing
3300 Test & Eval Support	368,723	186,741	103,097	83,478	83,478	83,478	83,478	Continuing
4000 Operational Support	89,557	43,360	47,996	47,581	38,563	32,328	31,476	Continuing
4302 Technology Transfer	2,239	2,862	2,862	2,862	2,862	2,862	2,862	Continuing
4305 Min Acc for PET	500	0	0	0	0	0	0	Completed
<b>SUBTOTAL</b>	<b>2,052,780</b>	<b>829,301</b>	<b>769,993</b>	<b>743,463</b>	<b>732,145</b>	<b>740,610</b>	<b>742,458</b>	

U N C L A S S I F I E D

U N C L A S S I F I E D

PE SUMMARY

Program Element: 0603217C  
PE Title: Ballistic Missile Defense (U)

Budget Activity: 03  
Advanced Technology Development (U)

A. (U) RESOURCES: (\$ In Thousands)

<u>Project Number and Title:</u>	<u>FY1993 Actual</u>	<u>FY1994 Estimate</u>	<u>FY1995 Estimate</u>	<u>FY1996 Estimate</u>	<u>FY1997 Estimate</u>	<u>FY1998 Estimate</u>	<u>FY1999 Estimate</u>	<u>Total Program</u>
<u>Military Construction</u>								
1105 Discrimination	2,500	0	0	0	0	0	0	0
3107 Envir Siting & Facil	0	2,727	530	2,992	2,082	2,725	2,325	Continuing
SUBTOTAL	2,500	2,727	530	2,992	2,082	2,725	2,325	
TOTAL	2,055,280	832,028	770,523	746,455	734,227	743,335	744,783	

B. (U) BRIEF DESCRIPTION OF ELEMENT:

Programs, projects, and activities that have a primary objective the development of technologies capable of supporting systems, components, and architectures that could produce highly effective defenses. Includes manpower authorizations and the associated costs specifically identified and measured to the performance of these programs.

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PE SUMMARY

Program Element: 0603218C

PE Title: Ballistic Missile Defense (U)

Budget Activity: 06  
Management Support (U)

A. (U) RESOURCES: (\$ In Thousands)

<u>Project Number</u> <u>and Title:</u>	<u>FY1993</u> <u>Actual</u>	<u>FY1994</u> <u>Estimate</u>	<u>FY1995</u> <u>Estimate</u>	<u>FY1996</u> <u>Estimate</u>	<u>FY1997</u> <u>Estimate</u>	<u>FY1998</u> <u>Estimate</u>	<u>FY1999</u> <u>Estimate</u>	<u>Total</u> <u>Program</u>
3300 Test & Eval Support	13,270	0	0	0	0	0	0	0 Continuing
4000 Operational Support	205,082	198,802	215,233	223,077	226,077	229,074	232,111	232,111 Continuing
<b>TOTAL</b>	<b>218,352</b>	<b>198,802</b>	<b>215,233</b>	<b>223,077</b>	<b>226,077</b>	<b>229,074</b>	<b>232,111</b>	

B. (U) BRIEF DESCRIPTION OF ELEMENT:

Provides for manpower authorizations and the associated costs specifically identified and measured to the oversight and management of ballistic missile defense systems RDT&E.

U N C L A S S I F I E D

U N C L A S S I F I E D

PE SUMMARY

Program Element: 0604216C  
 PE Title: Theater Missile Defense (U)  
 Budget Activity: 04  
 Demonstration and Validation (U)

A. (U) RESOURCES: (\$ in Thousands)

<u>Project Number and Title:</u>	<u>FY1993 Actual</u>	<u>FY1994 Estimate</u>	<u>FY1995 Estimate</u>	<u>FY1996 Estimate</u>	<u>FY1997 Estimate</u>	<u>FY1998 Estimate</u>	<u>FY1999 Estimate</u>	<u>Total Program</u>
2104 GBR	112,095	234,000	173,200	157,450	49,220	11,390	0	Continuing
2207 Patriot	94,470	80,684	69,240	30,960	0	0	0	Continuing
2208 ERINT	116,210	97,000	58,460	19,580	9,760	0	0	Continuing
2210 THAAD	273,000	434,658	495,690	457,290	0	0	0	Continuing
2213 Sea Based TMD Int	59,100	154,000	179,543	240,224	242,308	4,328	6,322	Continuing
2215 Adv Capbl Dem/Val Prg	0	0	0	0	0	164,690	260,980	Continuing
2308 HAWK System BM/C3	0	29,629	26,800	23,000	0	0	0	Completed
3211 C4I & Concepts Ops Anal	8,800	12,567	33,500	20,129	20,925	22,052	18,620	Continuing
3300 Test & Eval Support	21,700	37,952	34,850	37,510	24,870	0	0	Continuing
<b>TOTAL</b>	<b>685,375</b>	<b>1,080,490</b>	<b>1,071,283</b>	<b>986,143</b>	<b>347,083</b>	<b>202,460</b>	<b>285,922</b>	

B. (U) BRIEF DESCRIPTION OF ELEMENT:

Theater Missile Defense programs, projects, and activities that have an objective of system design and demonstration of the critical processes and technologies (early prototype) required for systems that are capable of providing a highly effective defense against theater missile threats. Includes manpower authorizations and the associated costs specifically identified and measured to the performance of these programs.

U N C L A S S I F I E D

U N C L A S S I F I E D

PE SUMMARY

Program Element: 0604217C

PE Title: Ballistic Missile Defense (U)

Budget Activity: 04

Demonstration and Validation (U)

A. (U) RESOURCES: (\$ in Thousands)

<u>Project Number and Title:</u>	<u>FY1993 Actual</u>	<u>FY1994 Estimate</u>	<u>FY1995 Estimate</u>	<u>FY1996 Estimate</u>	<u>FY1997 Estimate</u>	<u>FY1998 Estimate</u>	<u>FY1999 Estimate</u>	<u>Total Program</u>
2102 BE	209,900	0	120,000	150,000	150,000	200,000	200,000	4,558M
TOTAL	209,900	0	120,000	150,000	150,000	200,000	200,000	

B. (U) BRIEF DESCRIPTION OF ELEMENT:

Theater Missile Defense programs, projects, and activities that have an objective of system design and demonstration of the critical processes and technologies (early prototype) required for systems that are capable of providing a highly effective defense against theater missile threats. Includes manpower authorizations and the associated costs specifically identified and measured to the performance of these programs.

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U N C L A S S I F I E D

PE SUMMARY

Program Element: 0604225C  
 PE Title: Theater Missile Defense (U)  
 Budget Activity: 05  
 Engineering & Manufacturing Development (U)

A. (U) RESOURCES: (\$ In Thousands)

<u>Project Number and Title:</u>	<u>FY1993 Actual</u>	<u>FY1994 Estimate</u>	<u>FY1995 Estimate</u>	<u>FY1996 Estimate</u>	<u>FY1997 Estimate</u>	<u>FY1998 Estimate</u>	<u>FY1999 Estimate</u>	<u>Total Program</u>
2104 GBR	0	0	0	9,790	145,130	150,880	123,240	Continuing
2207 Patriot	0	42,097	217,200	205,620	134,230	44,440	0	Continuing
2210 THAAD	0	0	0	0	403,300	568,900	508,375	Continuing
2213 Sea Based TMD Int	0	0	0	0	0	137,760	104,390	Continuing
3211 C4I & Concepts Ops Anal	0	0	555	16,166	22,976	23,491	34,780	Continuing
<b>TOTAL</b>	<b>0</b>	<b>42,097</b>	<b>217,755</b>	<b>231,576</b>	<b>705,636</b>	<b>925,471</b>	<b>770,785</b>	

B. (U) BRIEF DESCRIPTION OF ELEMENT:

Theater Missile Defense programs, projects and activities that have an objective to mature and finalize selected system designs, validate manufacturing and production processes, test and evaluate systems that are capable of providing a highly effective defense against theater missile threats. Includes manpower authorizations and the associated costs specifically identified and measured to the performance of these programs.

U N C L A S S I F I E D



## **RDT&E DESCRIPTIVE SUMMARIES**

U N C L A S S I F I E D

FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C  
PE Title: Ballistic Missile Defense (U)

Project Number: 1101  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

A. (U) RESOURCES: (\$ in Thousands)  
Passive Sensors

Program Name: 0603217C RDT&E	FY1993 Actual	FY1994				FY1995		FY1996		FY1997		FY1998		FY1999		Total	
		Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Program	Continuing
	20,357	9,822			24,500		26,600		25,500		12,900		12,500				

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) This program performs research & development in: visible through infrared focal plane arrays, cryogenic cooling, optics hardware and cryogenic-based signal processing technologies. The efforts are crucial toward fielding National and Theater Missile (NMD, TMD) systems. Specific technology areas include: infrared focal plane arrays using silicon and mercury cadmium telluride materials, focal plane readouts using state-of-the-art electronics components, mirror hardware using silicon carbide or beryllium, innovative cryogenic signal processing techniques; maintenance of optical and electro-optical test facilities to verify component performance, cryogenic cooler development to cool focal plane arrays and associated optical hardware, sensor performance models and optical signature software codes which allow modeling of optical systems.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

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## FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1101  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

### C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

#### (U) FY 1993 Accomplishments:

- o (\$2.5M) The Mosaic Array Data Compression and Analysis Program (MADCAP) was continued. Prototype processors were developed for a three color sensor.
- o (\$2.0M) Readouts for large area MWIR HgCdTe arrays were designed and fabricated.
- o (\$2.2M) Readouts for low noise LWIR HgCdTe arrays were designed and fabricated.
- o (\$3.6M) Program to fabricate silicon staring focal planes arrays was initiated.
- o (\$1.5M) 512x512 InSb focal plane arrays were delivered.
- o (\$190K) InSb camera based on 512x512 camera was designed.
- o (\$0.5M) Life testing of several long life Stirling cryocoolers was continued.
- o (\$130K) Fabricated hardened narrow band filters.
- o (\$1.4M) Integrated turbo cooler and demonstrated proof-of-concept.
- o (\$0.5M) Added aerothermal heating to the Optical Signatures Code (OSC).
- o (\$1.2M) Tested silicon scanning focal plane arrays.
- o (\$0.4M) Continued investigation of MOCVD and MBE processes to fabricate HgCdTe.
- o (\$1.5M) Initiated 60K Stirling cooler program for cooling focal planes for BE.
- o (\$0.6M) Initiated 150K Stirling cooler program for cooling optics on BE.
- o (\$70K) Supported development of 60K cooler for flight demonstration.
- o (\$80K) Developed thermal storage device.
- o (\$50K) Initiated continuous sorption cooler program.
- o (\$0.7M) Performed radiation testing of focal planes and filters.
- o (\$0.7M) Maintained calibration chambers.
- o (\$0.5M) Developed calibration standards for focal planes.
- o (\$37K) Characterized SiC Mirrors.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1101  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

(U) FY 1994 Plans:  
0 (\$2.4M) Hybridize first lot of VLWIR silicon detectors.  
0 (\$1.0M) Deliver InSb cameras and complete design of InSb arrays for theater defense.  
0 (\$1.0M) Deliver MADCAP modules for HgCdTe focal plane arrays.  
0 (\$200K) Test MADCAP 3 color module at Arnold Engineering Development Center.  
0 (\$600K) Deliver advanced Stirling cooler.  
0 (\$400K) Initiate life testing of turbo-cooler and 65K coolers.  
0 (\$450K) Continue upgrades of OSC for TMD application.  
0 (\$100K) Initiate silicon carbide mirror program.  
0 (\$2.3M) Process HgCdTe for LWIR detectors.  
0 (\$1.052M) Radiometrically test focal plane arrays.  
0 (\$220K) Maintain calibration chambers  
0 (\$100K) Initiate new SiC mirror program.

(U) FY 1995 Plans:  
0 (\$4.6M) Deliver first lot of LWIR HgCdTe detectors.  
0 (\$2.0M) Complete first lot of MWIR HgCdTe detectors.  
0 (\$3.4M) Hybridize second lot of VLWIR silicon detectors.  
0 (\$700K) Continue life testing of Stirling and turbo coolers  
0 (\$500K) Continue upgrades of OSC for TMD application.  
0 (\$700K) Deliver SiC mirror blanks.  
0 (\$4.0M) Complete advanced design of 60K Stirling cooler.  
0 (\$1.3M) Complete design for flight ready turbo cooler.  
0 (\$1.0M) Radiometrically test focal plane arrays.  
0 (\$2.0M) Develop MADCAP modules in high density designs.  
0 (\$500K) Maintain calibration chambers.  
0 (\$700K) Develop flight ready jet spray contamination control device.  
0 (\$700K) Fabricate hardened coatings for filters.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1101

Budget Activity: 03

Adv Technology Dev (U)

February 1994

- o (\$1.0M) Deliver InSb focal plane arrays for theater defense application.
- o (\$900K) Restart sorption cooler program and complete designs.
- o (\$500K) Complete 150K Stirling cooler program.

(U) Program Plan to Completion: This is a continuing program.

D. (U) WORK PERFORMED BY:

(U) Major Contractors:

- o Hughes Aircraft - El Segundo, CA
- o Rockwell International - Anaheim, CA
- o Lockheed Missile Systems, Palo Alto, CA
- o Amber Engineering - Goleta, CA
- o Creare - Hanover, NH

E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

1. TECHNICAL CHANGES:

- o MADCAP effort modified to include processors for HgCdTe focal plane arrays so as to offer versatility.
- o Optical Signatures Code modified to place greater emphasis on the TMD mission.

2. SCHEDULE CHANGES: All programs have indefinite delivery / completion dates due to the FY94 crippling funding impact.

3. COST CHANGES:

- o Beryllium mirror program dropped.
- o Contamination control program dropped.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1101  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

- o Hardening coating program dropped.
- o Thermal storage device program dropped.
- o Optical test facilities (CALM, POST and MOST) dropped.
- o Quick Cooldown JT cooler program dropped.
- o Continuous IOK sorption program extended.
- o MWIR HgCdTe program extended.
- o LWIR HgCdTe program extended.
- o VLWIR silicon program extended.
- o Funding for testing of focal plane arrays halved.

F. (U) PROGRAM DOCUMENTATION: Characterization data for long life space coolers. Readout and detector designs for MWIR, LWIR and VLWIR detectors. Test data for MADCAP module performance. Test data for infrared detector performance.

G. (U) RELATED ACTIVITIES: This project provides high performance, radiation hardened, producible IR focal planes and cryocoolers for programs requiring IR sensors.

o 2102 BE	PE No. 0604217C
o 1214 AIT	PE No. 0603217C
o 1217 KKV Technology	PE No. 0603217C
o 2210 THAAD	PE No. 0604216C

Producibility efforts as well as radiation hardness goals will be coordinated with DARPA, DNA, and NASA. There is no duplication of effort within BMDO, DOD or the federal government.

H. (U) OTHER APPROPRIATION FUNDS: None

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1101  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

J. (U)

MILESTONE SCHEDULE:

0	Delivery of silicon IR arrays, lot 1	2Q/FY94
0	Delivery of turbo-cooler for testing	2Q/FY94
0	Fabrication of HgCdTe MADCAP module	2Q/FY94
0	Delivery of MWIR staring arrays, lot 1	2Q/FY95
0	Delivery of LWIR staring arrays, lot 1	2Q/FY95
0	Delivery of silicon IR arrays, lot 2	2Q/FY95
0	Fabricate 10K sorption cooler	3Q/FY95
0	Delivery of MWIR staring arrays, lot 2	1Q/FY96
0	Delivery of LWIR staring arrays, lot 2	1Q/FY96
0	Delivery of silicon IR arrays, lot 1	2Q/FY96
0	Delivery of MWIR staring arrays, lot 3	4Q/FY96
0	Delivery of LWIR staring arrays, lot 3	4Q/FY96

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FY1995 RDT&E DESCRIPTIVE SUMMARY (U)

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1102  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

A. (U) RESOURCES: (\$ in Thousands)  
Project Title: Radar

	FY1993	FY1994	FY1995	FY1996	FY1997	FY1998	FY1999	Total
<u>Program Name:</u>	<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Program</u>
0603217C RDT&E	10,305	1,631	10,000	9,000	9,000	9,000	9,000	Continuing

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) This project addresses advanced radar system designs and critical component technologies needed to build long range radar systems with search, detection, tracking, discrimination and kill assessment functions for multiple targets. Targets are threat ballistic missile reentry vehicles and associated objects at both endo- and exo-atmospheric ranges. This project provides the critical technologies for current as well as future radar systems that support BMDO architectures.

(U) As a result of the Secretary of Defense's Bottom-Up Review (BUR) in FY94, funding for the Radar Technology activities was reduced to approximately 16% of the FY93 level, and 25% of the planned FY94 expenditure. FY94 represents a transition year in which efforts will change focus from elements that support theater GBR to develop innovative concepts for a wide variety of theater radars.

(U) Large Radar Technology: This program is developing an advanced radar technology base necessary to meet the functional performance requirements of large aperture, phased array radars to support ballistic missile defense during all phases of threat flight. Emphasis is placed upon endo- and exo-atmospheric tracking, fire control, and engagement functions with focus on developing solid state RF components, fiber optic interconnects and waveform generating and processing components.

(U) Innovative Radar Technology: This program is developing radar technologies which have direct

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FY1995 RDT&E DESCRIPTIVE SUMMARY (U)

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1102

Budget Activity: 03

Adv Technology Dev (U)

February 1994

benefit for national and theater radars operating in electronic countermeasure and nuclear environments. Projects planned include techniques to coherently combine signals radiated from multiple radars, resonant target identification phenomenology, synthetic aperture radar hardware and demonstrations, and track error compensation technologies.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1993 Accomplishments:

- o (\$1.35M) Accepted delivery of 32 high power, solid state, transmit and receive modules assembled onto a single tray with 32 antenna elements.
- o (\$1.0M) Accepted delivery of 30 medium power, transmit and receive modules and 20 antenna elements.
- o (\$375K) PC Radcad work.
- o (\$260K) MIPR to MICOM to study fiber optic link to RFSS.
- o (\$750K) Optical Processing (Essex).
- o (\$400K) Optical Processing (Dynetics).
- o (\$400K) 2RNS ASIC fabrication.
- o (\$100K) Travel Budget, Equipments Purchase and ADP.
- o (\$1.25M) Radar waveform processing demo.
- o (\$300K) Close out RTWP real time waveform processing.
- o (\$1.1M) Demonstrated RF-to-Light-to-RF transmission with fiber optic components.
- o (\$1.0M) Developed and demonstrated fiber optic time delay unit.
- o (\$750K) Delivered High Density Power Conditioners.
- o (\$20K) Completed resonant radar cross section (RCS) signature testing.

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U N C L A S S I F I E D

FY1995 RDT&E DESCRIPTIVE SUMMARY (U)

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1102  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

o (\$1.25M) Data Acquisition System.

(U) FY 1994 Plans:

- o (\$25K) Travel/ADP.
- o (\$40K) ARCT (Advanced Radar Component Technology).
- o (\$863K) DAS (Data Acquisition System).
- o (\$180K) Acousto-Optic Processor (Dynetics).
- o (\$450K) Acousto-Optic Processor (Essex).
- o (\$30K) Continue development of Fiber Optic beamformer assembly.
- o (\$13K) Continue development of hardware and software components in support of Radar Waveform Processing Demonstration.
- o (\$30K) Radar Component Technology.

(U) FY 1995 Plans:

- o (\$3M) Initiate Active Ultra Wideband Aperture Subarray with Fiber Optic Manifold/Beam-former Architectures Program.
- o (\$3M) Advanced, highly integrated, Compact Waveform Generator (CDR)
- o (\$4M) Ultra high speed A/D convertor (CDR)

(U) Program Plan to Completion: This is a continuing program.

D. (U) WORK PERFORMED BY:

(U) This program is managed by the U.S. Army Strategic Defense Command, Huntsville, AL, (A1102) and by BMDO/TNS for Innovative Microwave Radar Research (S1102).

(U) Major Contractors:

o Phase IV - Huntsville, AL (subcontractor Westinghouse - Baltimore, MD)

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FY1995 RDT&E DESCRIPTIVE SUMMARY (U)

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1102  
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- o Texas Instruments - Dallas, TX
- o Dynetics - Huntsville, AL
- o Martin Marietta - Syracuse, NY

E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

I. TECHNICAL CHANGES:

- o Current funding maintains core radar technology work while program is redirected.
- o Establishment of RFSS/ARC Optical Communications link stopped.
- o Drop Synthetic Aperture Radar Demo Plans

2. SCHEDULE CHANGES:

- o Delay FY94 Advanced Radar Component Technology Program Award (9mo's)
- o Delay Advanced Active Aperture Contract Award (FY94 to FY95)
- o System Demo schedules for Enhanced GBR Operation slipped by 1 year

3. COST CHANGES:

- o Reduction in FY94 funding of \$4.913M from April 93 mark of \$6.544M to the present mark of \$1.631M.

F. (U) PROGRAM DOCUMENTATION: Solid state module and Waveform Generator/Return Simulator Hardware Demonstrations and associated test results.

G. (U) RELATED ACTIVITIES:

(U) Supports the effort to build and test the demonstration/ validation Ground Based Radars in 1995-96, and the independent radar discrimination engineering developments needed for exo-atmospheric target identification. These technologies further complement radar enhancement programs being undertaken in the BMD Theater Missile Defense office (TMD). There is no unnecessary duplication of effort within BMD or

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FY1995 RDT&E DESCRIPTIVE SUMMARY (U)

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1102  
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the DoD.

H. (U) OTHER APPROPRIATION FUNDS: None

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

J. (U) MILESTONE SCHEDULE:

- o Delivery of arbitrary coded waveform generator 2Q/FY94
- o Fabrication of Real Time Waveform Processor (RTWP) 2Q/FY95
- o (Single Channel Brassboard)
- o Demonstration test for fiber optic beamforming components 3Q/FY95
- o Perform Radar Waveform Processor Demonstration 2Q/FY97
- o Perform Radar Waveform Processor Demonstration 2Q/FY97

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1104  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

A. (U) RESOURCES: (\$ in Thousands)  
Project Title: Signal Processing

	FY1993	FY1994	FY1995	FY1996	FY1997	FY1998	FY1999	Total
<u>Program Name:</u>	<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Program</u>
0603217C RDT&E	18,410	6,914	7,100	12,000	13,500	7,000	5,000	Continuing

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) This project develops and demonstrates the technology, techniques and components to meet with stringent signal and data processing requirements in support of theater and national ballistic missile defense needs. It accomplishes this task by advancing the radiation hardened, high speed microelectronic, microprocessor, and analog circuit technology base. To meet ballistic missile mission objectives, on board processors must perform large numbers of computations to perform surveillance, acquisition, tracking, intercept, and kill assessment of missiles and reentry vehicles. These elements must survive and continue to perform in potential high levels of natural and man made nuclear radiation. Selected elements must continue to operate through very high flash levels of nuclear burst. High speed and low power Very Large Scale Integrated (VLSI) electronic circuits and memories with performance comparable to DoD Very High Speed Integrated Circuit (VHSIC) technology must be developed to achieve very high levels of performance and radiation hardening. Space borne electronics must use advanced packaging techniques to reduce satellite size, weight, power, and total system costs. Further development of these technologies are absolutely critical to lowering the risk and system costs involved with a deployment/full scale development decision. This project will produce two radiation hardened state-of-the-art 32 bit Reduced Instruction Set Computers (RISC) for space applications. The level of testability, fault tolerance and radiation immunity built into these processors distinguish the RH32 processors from others available or planned, and enable the RH32 to operate through the harsh space radiation environment. A companion effort, the RISC Ada Environment (RISCAE), will develop the software environment for both processor designs. Other programs include a Wafer Scale Vector Processor for very

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C  
PE Title: Ballistic Missile Defense (U)

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high speed signal processing, and advanced packaging to reduce size, weight and power of system microelectronics. As full scale deployment decisions are postponed, this project must ensure advances realized in the commercial market are easily transferred to the radiation hardened technology base.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1993 Accomplishments:

- o (\$600K) Continued rad hard nonvolatile memory efforts in battery backed 256K SOI SRAMS and ferroelectric technology.
- o (\$810K) Continued the rad hard precision voltage reference effort.
- o (\$4M) Delivered a space qualified, RAD hard CPM on the ASCM effort.
- o (\$800K) Continued rad hard 1MHz, 10 bit monolithic A/D converter.
- o (\$1.2M) Initiated rad hard 10 Mhz, 12-bit monolithic A/D converter.
- o (\$5M) Continued rad hard 32-bit (RH-32) scalar microprocessor development effort.
- o (\$2M) Continued RISCAC effort to develop an Ada software environment for the RH-32 microprocessor.
- o (\$300K) Continued the Associative String Signal Processor effort.
- o (\$500K) Support Argos satellite experiment.
- o (\$3.2M) Material Development & Testing.

(U) FY 1994 Plans:

- o (\$1.9M) Develop advanced packaging Techniques.
- o (\$500K) Develop interoperability hardware & standards.
- o (\$500K) Develop Wafer Scale Vector Processor.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

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0	(\$800K)	Complete RH32 and Ada environment .
0	(\$900K)	Continue rad hard memory development.
0	(\$900K)	Continue A/D converter.
0	(\$600K)	Continue rad hard non volatile memory.
0	(\$400K)	Continue material development.
0	(\$300K)	Continue auto rad hard design.
0	(\$114K)	Component testing.

(U) FY 1995 Plans:

0	(\$500K)	Continue the radiation hardened precision voltage reference.
0	(\$500K)	Continue the rad hard 1MHz, 10 bit monolithic A/D converter.
0	(\$500K)	Continued Energy backed non volatile memory.
0	(\$500K)	Continue rad hard 10 Mhz, 12-bit monolithic A/D converter.
0	(\$2.0M)	Continue advanced packaging.
0	(\$2.5M)	Continue advanced processors.
0	(\$300K)	Continue material research.
0	(\$300K)	Component Testing.

(U) Program Plan to Completion: This is a continuing program.

D. (U) WORK PERFORMED BY:

(U) In House:

0	Phillips Laboratory - Kirtland AFB, NM
0	Naval Research Laboratory - Washington, DC
0	Naval Ocean Systems Center - San Diego, CA
0	Naval Weapons Support Center - Crane, IN
0	Rome Laboratory - Hanscom AFB, MA

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Program Element: 0603217C  
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- o Rome Laboratory - Griffis AFB, NY
- o Harry Diamond Laboratory - Adelphi, MD
- o USASDC - Huntsville, AL

(U) Major Contractors:

- o Analog Devices - Wilmington, MA
- o Boeing - Seattle, WA
- o Harris - Melbourne, FL
- o IBM - Manassas, VA
- o Raytheon - Sudbury, MA
- o Texas Instruments - Dallas, TX
- o Honeywell - Plymouth, MN, Tampa, FL
- o General Electric - Schenectady, NY
- o TRW - Redondo Beach, CA

E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

1. TECHNICAL CHANGES: Remain the same
2. SCHEDULE CHANGES: Delays many discrete components, possibly resulting in non availability for systems. Funding reduction may result in outdated, obsolete technology feeding space and radiation hardened missile defense systems. Further delays erode the radiation hardened technology base.
3. COST CHANGES: Major microelectronics/signal processing projects are put in great jeopardy. The RH32 processor may be cancelled just prior to final chip production, deleteriously affecting Brilliant Eyes, FEWS follow-on, and other deep space systems.

F. (U) PROGRAM DOCUMENTATION: Design and test results of developed components.

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## FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1104

Budget Activity: 03

Adv Technology Dev (U)

February 1994

### G. (U) RELATED ACTIVITIES:

(U) This project provides radiation hardened microelectronics technology for all other space based and interceptor elements including Brilliant Eyes (BE), Early Warning System (EWS), Endoatmospheric and future endo interceptors, and Interceptor Technology Demo programs (PE No. 0603217C), theater interceptors, and advanced technology interceptors. The radiation tolerance and survivability goals programs are coordinated with the Survivability program. This project operates in coordination with the Defense Nuclear Agency and service radiation hardened microelectronics technology efforts. There is no unnecessary duplication of effort within BMDO or the DoD.

### H. (U) OTHER APPROPRIATION FUNDS: None

### I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

### J. (U) MILESTONE SCHEDULE:

o	Radiation hardened 10 Mhz, 12-bit monolithic A/D converter	1Q/FY95
o	Radiation hardened 32-bit processor (RH32)	2Q/FY94
o	Voltage reference	1Q/FY95
o	Software to operate the RH32 (RISCAE)	3Q/FY94
o	RH32/RISCAE integration	3Q/FY94
o	Radiation hardened precision voltage reference	2Q/FY95
o	Radiation hardened 1 Mbit SRAM	1Q/FY96
o	Analog-to-Digital converter 12-bit 10 MSPS	4Q/FY95
o	Rad Hard DC to DC converter	1Q/FY95
o	Automated rad hard circuit design	4Q/FY96

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C/0603216C

PE Title: Ballistic Missile Defense / Theater Missile Defense (U)

Project Number: 1105  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

A. (U) RESOURCES: (\$ in Thousands)  
Project Title: Discrimination

Program Name:	FY1993	FY1994	FY1995	FY1996	FY1997	FY1998	FY1999	Total
0603216C RDT&E	Actual	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Program
0603217C RDT&E	11,360	4,000	58,119	52,014	47,014	56,014	43,514	Continuing
0603217C MILCON	84,712	54,404	29,382	14,986	10,986	8,986	15,986	Continuing
	2,500	0	0	0	0	0	0	Continuing

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) This task area is responsible for characterizing the optical and radar signatures of threat objects (e.g. booster plumes, missile bodies, penairds and Rvs) and backgrounds for development of effective target acquisition and discrimination techniques for BMD0. Emphasis is placed on the midcourse and terminal phases of ballistic missile flight. Activities include: data collection and analysis of missile plume signature data, acquisition of radar data on missile targets, collection of data on low altitude (Endo and low Exo) targets; analysis of background data (Cryogenic Infrared Radiance Instrumentation for Shuttle (CIRRS IA); and development of phenomenology models, discriminated architecture, discrimination algorithms, (Lexington Discrimination System (LDS)), and integrated tools (i.e. Strategic Scene Generation Model (SSGM)) for a realistic assessment of surveillance, acquisition, tracking, and discrimination techniques. TCMP (TMD Critical Measurements Program) includes many of the above mentioned phenomenology and discrimination data collection with particular emphasis of satisfying TMD MDAP requirements. It includes flight tests (2-4 shots from Wake Island to USAKA at Kwajalein Atoll).

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

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Program Element: 0603217C/0603216C

PE Title: Ballistic Missile Defense / Theater Missile Defense (U)

Project Number: 1105  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1993 Accomplishments:

0 (\$11.360M) TMD Discrimination

- Conducted TCMP-1 experimental flight test.
- Analyzed TCMP Campaign I flight test data and reported preliminary test results.
- Began planning for TCMP Campaign II experimental flight test based on TCMP Campaign I results.
- Formulated a Kill Assessment data collection plan.
- Observed three sled tests at Holloman AFB gathering pulse doppler data of the impact scene.
- Observed ERINT intercept of STORM target with a multi-spectral sensor suite at WSMR.

0 (\$10.900M) Cobra Eye

- Collected optical data on flight experiments.

0 (\$28.3M) Observation Island

- Collected and analyzed radar data on flight experiments.

0 (\$7.0M) Radar Discrimination

- Analyzed radar data on flight experiments and forwarded the information to BMDO data centers for use.

- Completed data analysis of Firebird 1B mission.

- Analyzed TCMP Campaign I flight test data and reported preliminary test results.

- Continued to evaluate midcourse discrimination algorithms using collected data sets.

- Demonstrated passive discrimination algorithm architecture (1 target) on LDS test bed.

0 (\$4.700M) Optical Discrimination

- Analyzed optical data sets for threat/target characterization.

- Continued development, evaluation, & validation of passive discrimination algorithms.

0 (\$1.015M) Foreign Test Support

- Joint program for data collection on ballistic missile targets.

0 (\$5.124M) Natural Backgrounds

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C/0603216C

PE Title: Ballistic Missile Defense / Theater Missile Defense (U)

Project Number: 1105  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

- 0 - Began analysis of CIRRIIS 1A backgrounds models & codes (SHARC, SAMM, MOSART, CBSD, AURIC) (\$7.101M) Plume Phenomenology
- 0 - Completed data analysis of plume chamber tests to support models & codes.
- 0 - Continued to support foreign cooperative programs.
- 0 - Continued analysis of available plume data to understand underlying chemistry & physics & to validate accuracy of models.
- 0 (\$6.725M) Accomplishments
  - Successfully executed six data collection missions for BMDO.
  - Completed major airframe & sensor system upgrades.
- 0 (\$3.500M) Strategic Scene Generation Model (SSGM)
  - Completed SSGM Phase II development (baseline version)
    - Released SSGM v.4.0 & v.5.0 to user community.
  - Initiated Phase III of SSGM development (operational version).
- 0 (\$4.750M) Firepond/Firefly/Firebird
  - Firepond/Millstone Hill site supported ABL atmospheric compensation tests, B.E. ground sensor equipment tests, & sensor fusion/optical-to-radar handover experiments for TMD.
  - Firebird data analysis.
- 0 (\$1.595M) PSAG
  - Provided phenomenology support to BMDO studies & experiments.
  - Assisted in planning & analysis of data collection opportunities for plume measurements, background clutter, ascent & reentry.
- 0 (\$4.002M) COMET Program
  - Continued planning & execution of plume data collections on strategic class missile systems with Argus, HALO/IRIS, & ground based optical assets.
- 0 (\$2.500M) Military construction at Barking Sands, PMRF.
- (U) FY 1994 Plans:
  - 0 (\$4.000M) TMD Discrimination

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C/0603216C

PE Title: Ballistic Missile Defense / Theater Missile Defense (U)

Project Number: 1105  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

- Prepare TCMP Campaign I final report.
- Complete TCMP Campaign II experimental flight test plan.
- Begin planning for TCMP Campaign III experimental flight test.
- Observe live fire tests at WSMR to gather multi-spectral imagery of intercept scenes.
- Support LDS/ODA ongoing efforts in algorithm development for discrimination and kill assessment.
- 0 (\$33.3M) Observation Island
  - O&M costs for data collection efforts to continue radar data acquisition of missile targets.
  - Analyze data collected on flight experiments.
- 0 (\$4.057M) Radar Discrimination
  - Analysis of radar data on missile targets to be used by TMD & NMD for BMDO radar acquisition programs.
  - Continue development of radar and optical discrimination algorithms/architecture at LDS for system elements.
  - Demonstrate active/passive discrimination algorithm architecture (1 target) on LDS test bed.
- 0 (\$3.000M) Cobra Eye will be in a mothball status for FY94.
- 0 (\$4.000M) Optical Discrimination
  - Continue development of radar & optical discrimination algorithms/architecture a LDS for system element.
- 0 (\$1.500M) Natural Backgrounds
  - Continue analysis of CIRRIIS 1A mission data.
- 0 Release CIRRIIS 1A data (50 percent data set) to Background Data Center.
- 0 (\$500K) Argus
  - Support data collection missions and reduce applicable data.
- 0 (\$1.000M) Plume Phenomenology
  - Continue to support foreign cooperative programs.
- 0 (\$3.306M) SSGM
  - Continue developing the operational strategic Scene Generation Model.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C/0603216C

PE Title: Ballistic Missile Defense / Theater Missile Defense (U)

Project Number: 1105  
Budget Activity: 03  
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February 1994

- Study the TMD aspect of target acquisition and see if SSGM can be used in the theater environment.
- 0 (\$0.941M) PSAG
  - Provide BMDO with science experts to aid in understanding radar & optical phenomenology.
  - Aid in mission and experiment planning to ensure maximum benefit for each mission preformed.
- 0 (\$1.8M) COMET
  - Continue optical & infrared measurements of post-boost vehicle and missile targets.
  - Continue collecting phenomenology data on strategic class targets.
- 0 (\$1.0M) UPD
  - Develop autonomous short-term discrimination algorithm architecture (1 target) on LDS test bed.

(U) FY 1995 Plans:

0 (\$24.000M) TMD Discrimination

- Conduct TCMP Campaign II experimental flight test.
- Begin analysis of TCMP Campaign II flight test data.
- Complete TCMP Campaign II data analysis and report test results.
- Complete TCMP Campaign III experimental flight test plan.
- Observe live fire intercepts at WSMR as required.

\$ 4M { - Support LDS/ODA ongoing efforts in algorithm development for discrimination and kill assessment.

0 (\$35.001M) Observation Island

- O&M cost for radar data collection efforts on missiles.
- Analyze data collected on flight experiments.

0 (\$5.0M) Radar Discrimination

- Continue data analysis for use by BMDO radar acquisition programs in TMD and NMD.
- Demonstrate active/passive discrimination algorithm architecture (multiple targets) on LDS test bed.

0 (\$3.00M) Cobra Eye

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## FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C/0603216C

PE Title: Ballistic Missile Defense / Theater Missile Defense (U)

Project Number: 1105  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

- 0 - Continue mothball status
- 0 (\$5.00M) Optical Discrimination
  - Provide prototype optical algorithms for endo atmospheric discrimination, aimpoint selection, kill assessment.
- 0 (\$2.0M) Backgrounds
  - Continue depositing of CIRRIS IA data to the Backgrounds Data Center.
- 0 (\$1.50M) Plumes
  - Continue providing data to the Plume Data Center.
- 0 (\$3.5M) SSGM
  - Continue development of SSGM operational second release.
- 0 (\$3.0M) PSAG
  - Continued BMD0 science expert support & mission planning.
- 0 (\$1.5M) COMET
  - Continue phenomenology data collection on theater & strategic targets.
- 0 (\$4.0M) UPD
  - Deliver generated robust algorithms for interceptor application.
  - Demonstrate interceptor discrimination algorithms against field data.

(U) Program Plan to Completion: This is a continuing program.

D. (U) WORK PERFORMED BY:

- (U) Major Contractors:
- 0 Phillips Laboratory (Geophysics Directorate) - Lexington, MA
  - 0 Naval Research Laboratory - Washington, DC
  - 0 USAF Space Systems Division - El Segundo, CA
  - 0 USA Strategic Defense Command - Huntsville, AL
  - 0 Institute for Defense Analysis - Alexandria, VA

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PE Title: Ballistic Missile Defense / Theater Missile Defense (U)

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- 0 MIT Lincoln Laboratory - Lexington, MA
- 0 Mission Research Corporation - Santa Barbara, CA and Nashua, NH
- 0 Teledyne Brown Engineering - Huntsville, AL
- 0 USAF Materiel Command, Granville, TX
- 0 Sandia National Laboratory - Albuquerque, NM
- 0 Photon Research Associates, Inc - La Jolla, CA
- 0 Arnold Eng. Dev. Center - Tullahoma, TN
- 0 Nichols Research Corporation - Huntsville, AL
- 0 USAF Space and Missile Center, Norton AFB, CA
- 0 White Sands Missile Range - Albuquerque, NM

E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

1. TECHNICAL CHANGES:

2. SCHEDULE CHANGES:

3. COST CHANGES:

- 0 Spirit II backgrounds data will not be analyzed.
- 0 Observation Island measurements lease in FY96 due to loss of funding.
- 0 CE aircraft and sensor in storage beginning in FY93.
- 0 Laser radar program (Firebird, Firefly) unfunded beginning in FY93.

F. (U) PROGRAM DOCUMENTATION: Data reports from measurement programs. Reports describing discrimination models and algorithms.

- 0 Program Requirements Document - June 1992

G. (U) RELATED ACTIVITIES:

- 0 1106, "Midcourse Space Experiment", "Visible/Ultraviolet Experiment", and IBSS PE No. 0603217C.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Project Number: 1105  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

Program Element: 0603217C/0603216C  
PE Title: Ballistic Missile Defense / Theater Missile Defense (U)

o 3206 Countermeasures, PE No. 0603218C

There is no unnecessary duplication of effort within BMDO or the DoD

H. (U) OTHER APPROPRIATION FUNDS:

1. PROCUREMENT: None
2. MILITARY CONSTRUCTION: None in FY94

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Red Gemini.

J. (U) MILESTONE SCHEDULE:

- o Deliver prototype optical discrimination algorithms to GBI & THAAD
- o Campaign I final data report
- o Complete operational SSGM Model v. 1
- o Demonstrate active/passive discrimination architecture (1 tgt)
- o Campaign II flight test (2 sounding rockets)
- o Release background code SHARC v. 4.1
- o Release UV background code AURIC v. 2.0
- o Demonstrate real-time active/passive discrimination architecture for multiple targets
- o Complete operational SSGM Model v. 2
- o Campaign III flight test (2 sounding rockets)

1Q/FY94  
1Q/FY94  
2Q/FY94  
4Q/FY94  
4Q/FY94  
2Q/FY95  
4Q/FY95  
4Q/FY95  
2Q/FY95  
3Q/FY96

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C/0603217C

PE Title: Theater Missile Defense/Ballistic Missile Defense (U)

Project Number: 1106  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

A. (U) RESOURCES: (\$ in Thousands)  
Project Title: Sensor Studies and Experiments

Program Name:	FY1993 Actual	FY1994 Estimate	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	Total Program Continuing
0603216C RDT&E	78,528	30,066	28,500	35,000	30,000	0	0	
0603217C RDT&E	149,984	86,311	48,600	40,800	32,500	37,100	20,000	Continuing

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) This project conducts "tech-demo" experiments to integrate and assess newly developed sensor technologies in as realistic an operational environment as possible before they are transferred to missile defense systems elements.

(U) The TMD specific effort in this project comprises tactical cueing and netting demonstrations, including TMD weapons systems (i.e., PATRIOT, THAAD, etc.) cued by tactical sensors (Joint Tactical Ground Station (JTACS), SPY-1, TPS-59, etc.). Additional sensor development includes tactical processing and application of space sensor data in the Talon Shield project and airborne sensor technology development and contingency demonstration. Trial results of the United Kingdom's Multifunction Electronically Scanned Adaptive Radar (MESAR) will continue to be monitored. Data collected within this project are critical to the design of all TMD surveillance and weapon sensors and sensor processing algorithms. This project includes near-term (1994-1998) TMD sensor upgrades and technologies with application to theater missile defense (TMD). These demonstrations provide near-term sensor alternatives that address critical TMD sensor needs which includes netted sensor data processing improvements at key TMD nodes. These improvements are accomplished through block upgrades of existing sensor systems and/or the introduction of new technologies, particularly, in User Operational Evaluation System (UOES) form. Overall direction of this project is provided by the Near-term Demonstration and Capabilities Steering Group. This group is comprised of BMDO and Service PEO representatives.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C/0603217C

PE Title: Theater Missile Defense/Ballistic Missile Defense (U)

Project Number: 1106

Budget Activity: 03

Adv Technology Dev (U)  
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(U) FY93 RAPTOR/TALON sensor work in support of PMA 1215 (formerly under PMA 2106), PE 0603216C, is included in this descriptive summary. (Cross reference to PMA 1215, PE 0603217C)

(U) The Midcourse Space Experiment (MSX) will provide the system functional demonstrations, target data, statistically significant background data, and the technology demonstrations necessary for the midcourse sensor platforms to meet Milestone II. MSX will launch in CY94, and will perform a variety of experiments during its five year lifespan. The principal sensor is a cryogenic MWIR/LWIR/VLWIR radiometer and spectrometer system with high off-axis rejection optics, which will operate for 18 to 20 months. MSX will provide data on real midcourse targets against real backgrounds at realistic system ranges for use in system ground demonstrations; provide high quality target and background phenomenology data for further development of robust models of representative scenes; demonstrate key functions such as acquisition, tracking, handoff and bulk filtering; provide multi-wavelength target phenomenology data for assessing optical discrimination algorithms; and demonstrate the capability to integrate key technologies into a working platform similar to proposed operational midcourse sensor designs.

(U) The Red Tigris program consists of a series of joint US/UK sounding rocket launches to measure the signatures of advanced penetration aids. Data collected during these launches will be used to validate discrimination algorithms for TMD sensor and interceptor system elements.

(U) Advanced electro-optical sensor technologies being developed include visible, ultraviolet, and infrared radiation hardened charge-coupled device (CCD) imagers, step-stare sensor signal processing algorithms, and processor architectures to support evolving BMD midcourse surveillance concepts. Methodologies and techniques for performing track correlation and multisensor discrimination are also included. Progress will be verified by designing, building, and field testing sensors and by performing end-to-end simulations. Sensors will be demonstrated on the MSX experiment.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of

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FY1995 RDT&E DESCRIPTIVE SUMMARY

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the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1993 Accomplishments:

- 0 (10.850) Cueing and Netting
  - 0 Developed and tested PATRIOT cueing software; demonstrated new waveform during TCMP-1.
  - 0 Completed planning for PATRIOT/TPS-59/JTAGS cueing demonstration.
  - 0 Demonstrated PSS II system capabilities.
  - 0 Completed MESAR thinned array demonstration.
  - 0 Initiated field-deployable PSS II system tests.
  - 0 Completed PATRIOT discrimination effort.
  - 0 Conducted Passive Surveillance Sensor (PSS)-TMD architecture analysis.
  - 0 Conducted PSS II technical assessment.
  - 0 Continued tactical prototype PSS III system development work.
- 0 (20.500) Theater Air Force Sensors
  - 0 Completed Tactical Surveillance Demonstration (TSD), Radiant Ivory, and Talon Shield system demonstrations.
  - 0 Evaluated airborne sensor technology and requirements.
  - 0 Initiated field-deployable TSD system tests.
  - 0 Installed Central Tactical Processing Element (CTPE) at initial site.
- 0 (14.988) Near-Term Improvements
  - 0 Continued TPS-59 upgrade development.
  - 0 Evaluated RAPTOR/TALON boost phase intercept concept.
- 0 (3.900) Demonstrated seeker build up in lab.
- 0 (14.620) Documented conceptual design for a very high speed BPI concept.
- 0 (8.000) Completed TALON brassboard testing at DOE Nevada test site,

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- 0 (5.642) Conducted independent technical review of sensor concepts.
- 0 (108.52) Integrated MSX SBV, UVISI, and contamination instrument to the spacecraft. Finalized data processing and analysis plans and exercised data management system.
- 0 (18.99) Completed SPAS III Critical Design Reviews. Conducted simulations and completed processing and analysis plans.
- 0 (5.670) Fabricated LWIR CMOS Focal Plane Array.
- 0 (2.588) Performed ground based UPD demonstrations.
- 0 (1.174) Continued optical measurements from Malabar.
- 0 (13.070) Launched Red Tigress II.

### (U) FY 1994 Plans:

- 0 (1.395) Cueing and Netting
- 0 Conduct administrative and tactical cueing demonstrations between the TPS-59/PATRIOT/JTAGS systems.
- 0 Publish TPS-59/PATRIOT and JTAGS/PATRIOT Interface Control Documents.
- 0 Continue to monitor MESAR trials results.
- 0 (16.988) Theater Air Force Sensors
- 0 Complete Talon Shield developmental tests and begin Air Force Operations.
- 0 Initiate airborne sensor technology development and contingency demonstration.
- 0 (8.683) Near-Term Improvements
- 0 Transfer RAPTOR/TALON project to the follow-on technologies program.
- 0 Demonstrate improved netted sensor data processing at key TMD nodes.
- 0 Build optical sensor bench for data collection effort.
- 0 Conduct TMD-specific tests and modeling to assure successful element flight tests.
- 0 (5.000) MSX SPIRIT III sensor delivered to Johns Hopkins University/Applied Physics Lab (JHU/APL).
- 0 (74.955) Complete MSX integration, sensor calibration, environmental testing, flight acceptance testing, and ground system testing. Provide results to BMD Elements. Complete MSX ground system tests.

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- 0 (3.000) Test radiation hardened ultraviolet and visible CCDs; update signal processing and data processing technology; fabricate airborne sensor for WBST.
- 0 (3.356) Continue independent technical review of sensor concepts.
- 0 (3.000) Terminate SPAS III.
- 0 (0.000) Terminate Malabar optical collections.
- (U) FY 1995 Plans:
  - 0 (28.500) Near-Term Improvements
    - 0 Conduct airborne sensor design reviews.
    - 0 Continue integration of other sensor data sources into the ITERS architecture.
    - 0 Complete AWACS integration planning.
    - 0 Award airborne sensor development contract.
    - 0 Conduct Tri-Service contingency cueing demonstrations.
    - 0 Conduct data collection with optical sensor bench.
    - 0 Conduct TPS-59/PATRIOT and JTACS/PATRIOT cueing demonstration.
    - 0 Conduct SPY-1 to PATRIOT cueing demonstrations.
    - 0 Demonstrate improved netted sensor data processing at key TMD nodes.
    - 0 Continue TMD-specific tests and modeling to assure successful element flight tests.
  - 0 (45.130) Conduct MSX target experiments, and collect background and surveillance data. Perform quicklook and detailed analysis of MSX data to support system elements.
  - 0 (3.470) Make preparations for launch of Red Tigris III.

(U) Program Plan to Completion: This is a continuing program.

D. (U) WORK PERFORMED BY:

- 0 Phillips Laboratory - Lexington, MA, Albuquerque, NM
- 0 USA Program Executive Office - Huntsville, AL

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- 0 USA Space & Strategic Defense Command - Huntsville, AL
- 0 USAF Space & Missile Systems Center - El Segundo, CA
- 0 Sandia National Laboratory - Albuquerque, NM
- 0 Vandenberg Air Force Base - CA

(U) Major Contractors:

- 0 Raytheon Co. - Bedford, MA
- 0 Aerojet - Azusa, CA
- 0 IBM - Owego, NY

0 Various U.S./Allied contractors and government laboratories will be selected to participate in TMD experiments

- 0 Johns Hopkins University, Applied Physics Laboratory - Laurel, MD
- 0 Utah State University, Space Dynamics Laboratory - Logan, UT
- 0 MIT Lincoln Laboratory - Lexington, MA
- 0 McDonnell Douglas Aerospace - Huntington Beach, CA
- 0 Lockheed Missile Systems Corporation - Palo Alto, CA
- 0 Teledyne Brown Engineering - Huntsville, AL
- 0 Aerospace Corporation - El Segundo, CA
- 0 Rocketdyne - Canoga Park, CA
- 0 Honeywell - Clearwater, FL
- 0 Jet Propulsion Laboratory - Pasadena, CA
- 0 Hughes - El Segundo, CA
- 0 Photon Research Associates - San Diego, CA

E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

1. TECHNICAL CHANGES:

- 0 AN/TPS-59 moved to project 2308 and UPD to project 1105.

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0 Passive Surveillance sensor program terminated.

2. SCHEDULE CHANGES:  
0 None

3. COST CHANGES:  
0 Malabar and SPAS III are unfunded in FY94.

F. (U) PROGRAM DOCUMENTATION:

- 0 BMDO program management agreements/GM program management directives.
- 0 Monthly status reports on experiments programs, in-process reviews, and technical interchange meetings.
- 0 MSX Program Management Plan, Target System Requirements Document Experiment Plans, Data Analysis Plans
- 0 MSX System Requirements Document
- 0 MSX Science and Modeling Requirements Document

G. (U) RELATED ACTIVITIES:

- 0 2207 PATRIOT
- 0 2210 THAAD
- 0 2213 Sea-based TBMD
- 0 2308 HAWK BMC3 Mods
- 0 3201 Architecture Studies
- 0 3211 C4I
- 0 There is no unnecessary duplication of effort within BMDO or the DoD.

PE No. 6.4/6.5  
PE No. 6.4/6.5  
PE No. 6.4/6.5  
PE No. 6.3  
PE No. 6.3  
PE No. 6.3/6.4

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H.	(U)	<u>OTHER APPROPRIATION FUNDS:</u>	None	
I.	(U)	<u>INTERNATIONAL COOPERATIVE AGREEMENTS:</u>	None	
J.	(U)	<u>MILESTONE SCHEDULE:</u>		
0		PATRIOT "developmental" cueing demo		1Q/FY94
0		Airborne sensor development begins		1Q/FY94
0		PATRIOT "developmental" cueing demo final report		2Q/FY94
0		Talon Shield contract ends		3Q/FY94
0		Airborne sensor development contract award		3Q/FY94
0		Build optical bench for data collection effort		3Q/FY94
0		PATRIOT "tactical" cueing final report		4Q/FY94
0		Airborne sensor hardware production begins		FY95
0		Talon Shield operational tests		FY95
0		Airborne sensor integration into aircraft		FY96
0		MSX Integration Complete		3Q/FY94
0		MSX Acceptance Tests Complete		3Q/FY94
0		MSX launch		1Q/FY95
0		MSX target flights		FY95/96
0		MSX SPIRIT III EOL		2Q/FY96

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A. (U) Resources: (\$ in Thousands)  
Project Title: Sensor Integration

Program Name:	FY1993	FY1994	FY1995	FY1996	FY1997	FY1998	FY1999	Total
0603217C RDT&E	<u>Actual</u> 53,370	<u>Estimate</u> 25,306	<u>Estimate</u> 0	<u>Estimate</u> 0	<u>Estimate</u> 0	<u>Estimate</u> 0	<u>Estimate</u> 0	<u>Program</u> Completed

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) This program is divided in three parts. The first part of the program is used to develop advanced miniature components for surveillance, acquisition, tracking, navigation, and image processing for space systems. The second part integrates the lightweight components in a spacecraft payload. Finally, the third part includes the launching, mission operations, and data processing required to understand the performance of these assemblies in a long life space environmental mission.

(U) This project is designed to integrate and perform flight qualification of some of the most advanced BMDO lightweight technologies being developed. Lightweight spacecraft are being designed, built, and launched in the sensor integration program, usually referred to as the Clementine spacecraft. These spacecraft will be flown to fully characterize the effects of a radiation stressed environment on the lightweight technologies. The Clementine spacecraft has a lightweight suite of sensors (Ultraviolet/Visible, Near-Infrared, Long Wave Infrared, Lidar, and Star Trackers), lightweight attitude control systems (Inertial Measurement Units and Reaction Wheels), a 32-bit parallel computer processor architecture, high energy storage batteries, and high power density solar cells. This spacecraft will be flown in January 1994 using the Moon and a near-earth-asteroid as natural targets to measure the sensor performance. These spacecraft are being developed under a cooperative agreement with NASA to transfer DoD developed technologies to the civilian scientific sector.

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(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1993 Accomplishments:

0 (U) (\$4M) Conducted a Critical Design Review (CDR) for the Clementine spacecraft.  
0 (U) (\$20M) Integrated all the selected advanced technology subsystems into a bus/payload interface.  
0 (U) (\$1M) Conducted a technical panel with NASA leadership to enhance the scientific contribution of the Clementine program.  
0 (U) (\$20M) Tested the performance of a fully integrated payload for the Clementine deep space mission.  
0 (U) (\$8M) Performed a Test Readiness Review (TRR) to demonstrate integrated system performance.

(U) FY 1994 Plans:

0 (U) (\$1M) Conducted a Mission Readiness Review to discuss the results of the Clementine payload environmental test.  
0 (U) (\$10M) Final checkout of payload and launch vehicle for the Clementine mission.  
0 (U) (\$2M) Formed Engineering Team to evaluate advanced system performance.  
0 (U) (\$11M) Deep space flight of the first Clementine mission.  
0 (U) (\$1M) Distribution of the data obtained from the flight.

(U) FY 1995 Plans:  
0 None.

(U) Program Plan to Completion: Program completed in FY 1994.

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D. (U) WORK PERFORMED BY:

- 0 Naval Research Lab - Washington, DC
- 0 Lawrence Livermore National Lab - Livermore, CA
- 0 Jet Propulsion Laboratory - Pasadena, CA
- 0 Raytheon, Amber Engineer Division, Santa Barbara, CA
- 0 NASA Goddard Space Center
- 0 McDonnell Douglas - St. Louis, MO
- 0 Martin Marietta - Denver, CO
- 0 Bendix Field Operations, MD
- 0 Fairchild - Space Division, MD

E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

- 1. TECHNICAL CHANGES:
- 2. SCHEDULE CHANGES:
- 3. COST CHANGES: Reduced budget in the out-years.

F. (U) PROGRAM DOCUMENTATION:

- 0 Documentation of the performance of all spacecraft subsystems during flight.
- 0 Final Report Briefing of the Joint BMDO/NASA Study of BMDO Technology Applications to NASA Space Science objectives.

G. (U) RELATED ACTIVITIES:

- 0 2102 Brilliant Eyes PE 0604217C
- 0 1106 Sensor Studies PE 0603217

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- o 1504 Material and Structure PE 0603216C  
There is no unnecessary duplication of effort within BMD0 or the DoD.

H. (U) OTHER APPROPRIATE FUNDS: None

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

J. (U) MILESTONE SCHEDULE:

- |   |                                 |         |
|---|---------------------------------|---------|
| o | Mission Readiness Review        | 1Q/FY94 |
| o | Clementine -1 Spacecraft Launch | 2Q/FY94 |
| o | Clementine -1 Completion        | 4Q/FY94 |
| o | Clementine -1 Reports           | 1Q/FY95 |

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A. (U) Resources: (\$ in Thousands)  
Project Title: Advanced Sensor Technology

	FY1993	FY1994	FY1995	FY1996	FY1997	FY1998	FY1999	Total
<u>Program Name:</u>	<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Program</u>
0603217C RDT&E	43,989	36,527	48,000	48,000	48,000	48,000	48,000	Continuing

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) The overall objectives of this program are to provide for the development, independent government testing, and integration of state-of-art advanced technology demonstrations (ATDs) to develop sensor systems and demonstration of system operational concepts in realistic scenarios. Specifically, it develops follow-on sensor components, subsystems, and integrates developmental systems and conducts functional demonstrations to support theater air defense and dual use applications. The focus of follow-on sensor technologies, while exploring increased capabilities in the infrared, will include other small, lightweight, low power sensor concepts such as synthetic aperture radars, LIDAR, hyper spectral UV-to IR, on-FPA processing, multi-color FPA's, higher efficiency/long-life cryocoolers, etc. This broad range of activities may include potential projects of mutual benefit with our foreign friends and allies.

(U) This project also provides funding for the Miniature Sensor Technology Integration (MSTI) technology development program. The MSTI program will continue the development, integration, test and verification of on-orbit advanced miniaturized sensor technologies for space-based surveillance and ballistic missile track capability as well as environmental/ecological dual use applications. Using off-the-shelf hardware to the maximum extent possible, MSTI satellites are manufactured and launched rapidly, enabling MSTI technology achievements to aid the development efforts of space-based surveillance systems and demonstration of system operational concepts in realistic scenarios. MSTI will demonstrate monocular tracking capability in several IR wavebands, and will serve as a test bed for handover solutions to an interceptor with sufficient accuracy to enable a missile intercept. The MSTI satellites will observe the

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LEAP flights throughout the Navy LEAP and SRAM/LEAP flight test programs tracking the targets and handing off the information to suitable ground assets. The MSTI satellites will be used to validate the contribution of a space-based sensor to state-of-the-art interceptor flights. The MSTI bus will also perform orbital tests of interceptor seekers, processors, propulsion systems, communications systems, and other components in a long-duration space exposure environment which will provide performance data in support of interceptor EMD decisions. With MSTI satellites on-orbit together in a managed constellation, distributed sensor concepts using data fusion techniques will be explored. Concomitantly, launch point identification will be demonstrated as a by product of the on-board track file generation to evaluate the potential use of space-based sensors for counterforce operations. Additionally, the MSTI program includes the development of a mobile command and control capability, and will explore the potential use of space-based sensors for environmental/ecological monitoring and for executing joint, international space missions. It is expected that at an appropriate time during FY94, MSTI activities will be transferred to the Air Force.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

### C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

#### (U) FY 1993 Accomplishments:

- o (\$2.9M) Demonstrated first (pathfinder) Miniature Seeker Technology Integration (MSTI) satellite in orbital launch from Vandenberg on SCOUT launch vehicle. Collected MWIR background data for future mission planning.
- o (\$39.089M) Incorporated advanced SWIR and MWIR sensor technologies into MSTI-SCOUT 2 and planned tracking experiments of LEAP targets and targets of opportunity in several wavebands. Completed satellite design and planning 2Q94 launch. Initiated design of MSTI-3 satellite. MSTI-3 to

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utilize multiple waveband sensors to track targets, collect phenomenology and compute on-board limited track files for handoff to ground control assets. Developed system requirements for MSTI-4 satellite. Completed design for initial orbital cross-link and distributed sensor processing using multiple MSTI satellites.

- o (\$4M) Assessed feasibility of dual use of missile tracking space-based sensors and conducting joint technology cooperation projects with Russia, Israel, France, and UK.
- o (\$1.6M) Initiated design efforts for long-duration, stressing space environment mission (MSTI-5). Conducted preliminary feasibility tests for MSTI-5 subsystems.

(U) FY 1994 Plans:

- o (\$33.219M) Complete development and testing of MSTI-2 and -3. Execute on-orbit operations of MSTI-2 and -3 missions, including tracking of interceptor targets trajectories. Demonstrate advanced sensors in flight experiments on MSTI satellites. Continue development for advanced technology flight tests.
- o (\$2.0M) Perform closed loop tracking of theater ballistic missile-class targets and targets of opportunity in multiple wavebands. Collect background phenomenology data as secondary objective.
- o (\$308K) Continue integration of LEAP derived components into the Deep Space Program Science Experiment missions.
- o (\$200K) Develop advanced sensors concepts for future on-orbit demonstrations.
- o (\$800K) Develop and conduct joint program plans with the UK, France, Israel, and others.

(U) FY 1995 Plans:

- o (\$6.5M) Execute on-orbit operations of missions. Conduct advanced stereo-imaging experiments, generating track files of NAVY LEAP targets and other cooperative targets.
- o Perform closed-loop tracking for boosting and warm body targets in multiple band passes.
- o (\$38M) Evaluate and develop advanced sensor concepts (i.e., LWIR and LIDAR) for future BMDO missions. Pursue advanced sensor deployment on alternative satellite platforms. Evaluate advanced technology communications such as high data rate space-space cross-links and down down links.

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- o (\$2.6M) Continue data analysis/modeling efforts with data and with environmental/ecological communities. Continue to study innovative concepts for applying BMDO sensor technology to gather additional data of non-DoD, civilian, and environmental benefit.
- o (\$900K) Conduct joint data experiments gathering analysis with international partners.

(U) Program Plan to Completion: This is a continuing program.

D. (U) WORK PERFORMED BY:

(U) In-House:

- o Air Force Phillips Laboratory - Edwards AFB, CA
- o Jet Propulsion Laboratory - Pasadena, CA
- o AF Phillips Laboratory - Albuquerque, NM
- o AF Phillips Laboratory - Hanscom AFB, MA
- o Lawrence Livermore National Laboratory, CA
- o US Army Space and Strategic Defense Command - Huntsville, AL

(U) Contractor:

- o Spectrum Astro, Inc. - Gilbert, AZ
- o Rocketdyne Div, Rockwell Corp. - Canoga Park, CA
- o ANSER Corp. - Arlington, VA
- o Loral EOS - Pasadena, CA
- o Wyle Laboratories - El Segundo, CA
- o SPARTA Inc. - Laguna Hills, CA
- o ISI - Santa Clara, CA
- o SEMCO - San Diego, CA
- o Hughes Missile Systems Company - Canoga Park, CA
- o SAIC, San Diego, CA

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E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

1. TECHNICAL CHANGES:

- 0 Increased MSTI-3 payload capabilities by adding a visible wedge filter spectrometer to enhance data gathering efforts.
- 0 Increased MSTI participation with international partners to conduct joint data gathering (analysis efforts. Agreements are evolving with Israel, the UK, and France.
- 0 Delete MSTI-4 and MSTI-5 missions. Deleted space-to-space communications capability.
- 0 Adds Advanced Sensor Technology Program

2. SCHEDULE CHANGES:

- 0 MSTI-2 launch slipped to 20FY94 due to late hardware deliveries and correction of payload camera problems identified in integration and test. Slip provides increased data opportunities with MSTI-3.

3. COST CHANGES:

- 0 MSTI-4 and MSTI-5 have been terminated.
- 0 Budget reductions required MSTI-3 downsizing
- 0 Advanced Sensor Technology Program added for FY95 and beyond.

F. (U) PROGRAM DOCUMENTATION:

- |   |          |                               |       |
|---|----------|-------------------------------|-------|
| 0 | MSTI-2   | Mission Requirements Document | 4/93  |
| 0 | MSTI-2   | Mission Ops Plan              | 7/93  |
| 0 | MSTI-2   | CATEX                         | 7/93  |
| 0 | MSTI-2   | Treaty Certification          | 1/93  |
| 0 | MSTI-3   | Mission Requirements Document | 10/93 |
| 0 | MSTI-3   | Mission Ops Plan              | 2/94  |
| 0 | MSTI-3/4 | CATEX                         | 1/94  |

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- o MSTI-3 Treaty Certification 1/93
- G. (U) RELATED ACTIVITIES:
  - o 1210 LEAP Tech Demo Program PE No. 0603216C
  - o 1504 Materials and Structures Technology PE No. 0603217C
  - o 1201 Miniaturized Integration Technology and Validation PE No. 0603217C
  - Facilities Support PE No. 0603217C
  - o 1101 Passive Sensor Technologies
  - o 1102 Radar Technologies
  - o 1104 Signal Processing and Microelectronics

o There is no unnecessary duplication of effort within BMDO or the DoD.

H. (U) OTHER APPROPRIATION FUNDS: None

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Draft Agreement in place with Israel for joint data collections. Israel Foreign Disclosure Guidelines completed March 1, 1991, others are in work.

- J. (U) MILESTONE SCHEDULE:
  - o MSTI SCOUT- 1 Launch 1Q/FY93
  - o MSTI SCOUT- 2 Launch 2Q/FY94
  - o MSTI - 3 Launch 3Q/FY94
  - o Advanced Technology Program Initiated 1Q/FY95

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C/0603217C  
 PE Title: Theater Missile Defense / Ballistic Missile Defense (U)  
 Project Number: 1201  
 Budget Activity: 03  
 Adv Technology Dev (U)  
 February 1994

A. (U) RESOURCES: (\$ In Thousands)

Project Title: Interceptor Component Technology

Program Name:	FY1993 Actual	FY1994 Estimate	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	Total Program Continuing
0603216C RDT&E	0	8,000	5,000	5,000	0	0	0	
0603217C RDT&E	17,735	11,726	22,500	28,500	26,900	30,500	33,500	Continuing

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) This project is developing advanced components for lightweight, low cost interceptors for national and theater missile defense. The technologies provide a basis for highly effective interceptor systems that are deployable through the year 2000 and beyond. Technology development efforts focus on addressing the more stringent requirements, such as on-board discrimination, greater kinematic capability, enhanced autonomy, reduced mass and low cost. Component performance will be demonstrated through ground testing of hardware and software at contractor's facilities, the KKV Hardware-in-the-Loop Simulation (KHILS) facility, the National Hover Test Facility (NHTF), the Army Missile Optical Range (AMOR), and flight testing.

(U) Funding reductions made it necessary to cancel most of the work in this project in FY93 and FY94: The Pilotline Experiment Technology (PET) is one program that was continued. PET is developing producibility and automated testing techniques for hardened LWIR HgCdTe focal plane arrays. The LWIR Advanced Technology Seeker (LATS) program will continue to develop seeker components for long range acquisition, such as microlenses, cooled optics, micro scanning and gamma circumvention circuitry. These technologies will be integrated and demonstrated in a technology seeker evaluation unit (TSEU). Seeker components technologies that have been terminated range from the UV through the VLWIR. Recently initiated efforts in multicolor operation to aid in discrimination were all terminated. Miniature radar with agile beam steering is continuing for robust discrimination capability. A small effort to develop

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C/0603217C

PE Title: Theater Missile Defense / Ballistic Missile Defense (U)

Project Number: 1201  
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Adv Technology Dev (U)  
February 1994

accurate, miniature fiber optic inertial measurement units will continue at a reduced pace in FY94. This effort is also developing a gelled propellant divert and attitude control system (DACS) for THAAD.

(U) This project included funding in FY93 and FY94 for project 1204. Project 1204 is not funded in FY95.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

C. (U) PROGRAM ACCOMPLISHMENT AND PLANS:

(U) FY 1993 Accomplishments:

- o (\$7900K) Continued PET Phase II and development of production lot.
- o (\$1800K) Completed LATS TSEU-1 testing.
- o (\$1000K) Demonstrated 4 cm agile beam director.
- o (\$6000K) Began development of MSTI LIDAR.
- o (\$120K) Continued development of fiber optic Gyro Technology.
- o (\$500K) Completed fire control algorithm development.
- o (\$415K) Began development of multi-folded CO2 LADAR.

(U) FY 1994 Plans:

- o (\$2400K) Complete PET production lot development
- o (\$2000K) Begin PET pilotline production.
- o (\$600K) Begin LATS TSEU-2 integration.
- o (\$500K) Begin LATS TSEU-2 testing.
- o (\$200K) Continue LATS Flight Evaluation Unit (FEU) design.

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## FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C/0603217C

PE Title: Theater Missile Defense / Ballistic Missile Defense (U)

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- o (\$200K) Start Modular Architecture Processor (MAP) SOI Chip Set Design (New).
- o (\$50K) Demonstrate miniature resonant fiber optic gyro breadboard.
- o (\$1000K) Demonstrate 10 cm agile beam director.
- o (\$1400K) Complete solid state and C02 ladar design and fabrication.
- o (\$2500K) Continue development of discriminating sensor interstage module (Quad-D).
- o (\$8000K) Begin gelled propellant axial and divert engine development. (Restart)
- o (\$470K) Perform active seeker testing at AMOR.
- o (\$400K) Perform discrimination analyses.
- (U) FY 1995 Plans:
  - o (\$9000K) Continue PET pilotline lot development.
  - o (\$3400K) Complete LATS TSEU testing and FEU design.
  - o (\$200K) Complete MAP design, fabrication and hardware delivery.
  - o (\$1000K) Demonstrate 20 cm agile beam director.
  - o (\$10,000K) Continue gelled propellant divert and attitude control engine development.
  - o (\$1000K) Perform active seeker testing at AMOR.
  - o (\$400K) Perform discrimination analyses.
  - o (\$2000K) Begin testing of solid state and C02 LADARS.
  - o (\$500K) Continue development of FOG IMU.

(U) Program Plan to Completion: This is a continuing program.

D. (U) WORK PERFORMED BY:

- o Loral - Lexington, MA
- o Hughes/SBRC - Santa Barbara, CA
- o Lockheed, Palo Alto, CA
- o Honeywell, Tucson, AZ

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- o Raytheon, Wayland, MA
- o TDC, Huntsville, AL
- o Aerojet, Sacramento, CA

E. (U) COMPARISON WITH FY 1994 DESCRIPTION SUMMARY:

1. TECHNICAL CHANGES:

None

2. SCHEDULE CHANGES:

None

3. COST CHANGES: Budget reductions have led to a one year slip in the LATS and PET programs and have delayed the start of the MAP program by one year. Development of the mini IFOG IMU will continue at a significantly reduced pace.

F. (U) PROGRAM DOCUMENTATION:

- o BMDO/TNC Program Review 3/92
- o BMDO/DTC Program Review 5/93
- o Program Management Agreement (PMA 1201) 9/93
- o LATS IPR #4 10/93
- o Solid State Ladar Technology & Non-Mechanical Beam Steering Discrimination (Demo To MG O'Neill) 10/93
- o Various Technology Program Kickoff Meetings and In-Process Reviews 10/90-10/93

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C/0603217C

PE Title: Theater Missile Defense / Ballistic Missile Defense (U)

Project Number: 1201  
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G. (U) RELATED ACTIVITIES:

All BMDO Interceptors benefit from technologies developed in this Project.

H. (U) OTHER APPROPRIATION FUNDS: None

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Discussions with the United Kingdom on several component technology programs have ceased due to lack of funds.

J. (U) MILESTONE SCHEDULE:

o	Completed LATS TSEU-1 Testing	3Q/FY93
o	Demonstrated 4 cm Agile Beam Director	4Q/93
o	Complete PET Production Lot	3Q/94
o	Start MAP Program	2Q/94
o	Demonstrate Mini-RFOG	3Q/94
o	Demonstrate 10 cm Agile Beam Director	3Q/94
o	Integrate Agile Beam Director with Ladar	2Q/95
o	Begin Gelled Propellant Engine Development	2Q/94
o	Complete LATS FEU design	3Q/95
o	Deliver MAP Hardware	4Q/95
o	Demonstrate 20 cm Agile Beam Director	4Q/95
o	Deliver PET FPAs and Complete Producibility Demo	3Q/96
o	Perform Ladar/Agile Beam Director Demo	4Q/96

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1202  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

A. (U) RESOURCES:  
Project Title:

(\$ in Thousands)  
Interceptor Integration Technology

	FY1993	FY1994	FY1995	FY1996	FY1997	FY1998	FY1999	Total
Program Name:	Actual	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Program
0603217C RDT&E	136,336	0	0	0	0	0	0	Completed

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) This project provides funding of the Miniature Sensor Technology Integration (MSTI) technology development program. The overall objectives of this program are to provide for the development, independent government testing, and integration of state-of-art advanced technology demonstrations (ATDs) to aid the development efforts of space-based surveillance systems and demonstration of system operational concepts in realistic scenarios. Specifically, MSTI develops, integrates and tests low-cost, modular satellite busses and conducts on-orbit functional demonstrations of advanced technology integrated sensors that support theater missile launch detect and trackers and dual use applications. The standard MSTI spacecraft bus will support simplified, rapid integration and testing of multiple technology payloads. The MSTI bus will also perform orbital tests of interceptor seekers, processors, propulsion systems, communications systems, and other components in a long-duration space exposure environment which will provide performance data in support of interceptor EMD decisions. The various MSTI satellites will be used to collect optical phenomenon in multiple wavebands and performance information on LEAP flight tests, dedicated targets, and targets of opportunity. An incremental testing approach will be taken to evolve a MSTI plume tracking, cuing, and handover capability which can be used on advanced LEAP interceptor flight tests. In addition, the MSTI program will serve as BMDO's cornerstone for exploring the potential for dual use of DoD space-based sensors for environmental/ecological disaster monitoring and for executing joint, international space missions.

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PE Title: Ballistic Missile Defense (U)

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(U) This project provides funding for the Miniature Sensor Technology Integration (MSTI) technology development program. The MSTI program will develop, integrate, test and verify on-orbit advanced miniaturized sensor technologies for developing space-based surveillance and ballistic missile track capability and for environmental/ecological dual use applications. Using off-the-shelf hardware to the maximum extent possible, MSTI satellites will be manufactured and launched rapidly, enabling MSTI technology achievements to aid the development efforts of space-based surveillance systems and demonstration of system operational concepts in realistic scenarios. MSTI will demonstrate monocular and stereo tracking capabilities in several IR wavebands, and will serve as a test bed for handover solutions to an interceptor with sufficient accuracy to enable a missile intercept. The MSTI satellites will observe the LEAP flights throughout the Navy LEAP and SRAM/LEAP flight test programs tracking the targets and handing off the information to suitable ground assets. The MSTI satellites will be used to validate the contribution of a space-based sensor to state-of-the-art interceptor flights. With MSTI satellites on-orbit together in a managed constellation, distributed sensor concepts using space-to-space communications and data fusion techniques will be explored. Concomitantly, launch point identification will be demonstrated as a by product of the on-board track file generation to evaluate the potential use of space-based sensors for counterforce operations. Additionally, the MSTI program includes the development of a mobile command and control capability, and will explore the potential use of space-based sensors for environmental/ecological monitoring and for executing joint, international space missions. MSTI efforts under this project will be under project 1111 beginning in FY 1994. The project includes further development of Lightweight Exo-Atmospheric Projectiles (LEAP) and their associated technologies with specific application to the Short Range Attack Missile (SRAM)/LEAP. The LEAP Tech Demo program provides for the development independent government testing and experimental integration of state-of-the-art interceptor technologies to provide risk reduction for systems that could be deployed prior to the beginning of the next century. This program provides for development of advanced LEAP integrated technologies and advanced LEAP test planning for potential weapon system applications including SRAM/LEAP technology demonstrations. The program accomplishes planning and testing which could provide low-cost, low-risk demonstrated technology insertion options, based on LEAP interceptor technologies, using SRAM systems. It will provide a comprehensive demonstration of technology in support of developing effective,

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PE Title: Ballistic Missile Defense (U)

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near-term airborne ascent phase interceptor (API) Theater Missile Defense capabilities. It is also serving as a pathfinder for integration and approval of Air Force TMD systems aboard tactical aircraft and as a test bed for TMD BMC3 exercises. The program will perform a series of suborbital flight tests of LEAP modified USAF SRAMs with increasingly challenging mission scenarios that will validate the capability of LEAP technologies to perform exo-atmospheric intercepts of Theater Ballistic Missile type targets. A step-by-step approach will be used to demonstrate all the necessary elements of airborne TMD systems: exo-interceptors, boosters, kick stages, airborne launch systems, fire control systems and external cueing/BMC3 capabilities. In order to minimize cost, reduce risk, and enable early demonstrations, maximum use will be made of existing hardware, test facilities, test infrastructures, and procedures.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1993 Accomplishments:

o See PMA 1111 for MSTI accomplishments.

o (\$96.836M) In conjunction with PMA 1210, executed the LEAP Tech Demo program, including first full-up static and hover test of solid divert propelled projectile continued development of flight test kick stage motors for FY94 tests; three static tests of advanced kick stages; continued development of support equipment and projectiles for shipboard and ground-based flight test demonstration; (\$35.5M) Performed 1 km/sec intercept attempt of warm body (RV) target at WSMR (LEAP 3).  
o (\$4.0M) Developed detailed flight test plans and mission scenarios for proposed SRAM/LEAP technology integration demonstrations; performed two early high altitude feasibility demonstrations

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PE Title: Ballistic Missile Defense (U)

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of SRAM for air launched LEAP demonstrations using both the B-1B and B-52 aircraft (FT-2, FT-3); achieved successful fit check of SRAM/LEAP mockup abroad UK Tornado aircraft.

(U) FY 1994 Plans:

- o (not reflected in current funding line for 1202) Perform SRAM/LEAP operational demonstrations for ascent phase interceptors validating the capability to uplink fire control information to the missile interstage and the ability to separate and control the midcourse interceptor (LEAP/interstage/ASAS) through exoatmospheric flight. SCAN/LEAP will be launched from B52 and captive carried on F-15C. Cooperative program with the United Kingdom will be pursued/conducted.
- o Future sensor demonstrations transferred to project 1111.

(U) FY 1995 Plans:

- o (not reflected in current funding line for 1202) Deliver advanced KKV's and kicks stages for SRAM/LEAP.
- o (not reflected in current funding line for 1202) Perform SRAM/LEAP operational concept demonstrations from F-15 and B-52 aircraft with comprehensive suite of off-board sensors (AWACS, Cobra Ball, DSD,IRST, AEGIS) culminating in the intercept of a TBM representative target on several flights.
- o Future sensor demonstrations transferred to project 1111.

- (U) Program Plan to Completion: Project has been transferred to project 1111.

D. WORK PERFORMED BY:

- (U) In-House:
- o Air Force Phillips Laboratory - Edwards AFB, CA
- o Jet Propulsion Laboratory - Pasadena, CA
- o AF Phillips Laboratory - Albuquerque, NM

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Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

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- 0 AF Phillips Laboratory - Hanscom AFB, MA
- 0 Lawrence Livermore National Laboratory, CA
- 0 US Army Space and Strategic Defense Command - Huntsville, AL
- (U) Contractor:
  - 0 Spectrum Astro, Inc. - Gilbert, AZ
  - 0 Rocketdyne Div, Rockwell Corp. - Canoga Park, CA
  - 0 ANSER Corp. - Arlington, VA
  - 0 Loral EOS - Pasadena, CA
  - 0 Wyle Laboratories - El Segundo, CA
  - 0 SPARTA Inc. - Laguna Hills, CA
  - 0 ISI - Santa Clara, CA
  - 0 SEMCO - San Diego, CA
  - 0 Hughes Missile Systems Company - Canoga Park, CA
  - 0 Boeing - Seattle, WA

E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

- 1. TECHNICAL CHANGES:
  - 0 Future sensor demonstrations transferred to project 1111.
- 2. SCHEDULE CHANGES:
  - 0 Future sensor demonstrations transferred to project 1111.
- 3. COST CHANGES:
  - 0 Future sensor demonstrations transferred to project 1111.

F. (U) PROGRAM DOCUMENTATION:

- 0 MSTI-2 Mission Requirements Document 4/93

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0	MSTI-2	Mission Ops Plan	7/93
0	MSTI-2	CATEX	7/93
0	MSTI-2/3	Treaty Certification	1/93
0	MSTI-3	Mission Requirements Document	10/93
0	MSTI-3	Mission Ops Plan	2/94
0	MSTI-3		1/94
0	MSTI-3	Treaty Certification	1/94
0	SRAM/LEAP	Treaty Compliance Certification	2/94
0	SRAM/LEAP	Operational Requirements Documents	as necessary
0	SRAM/LEAP	Flight Test Plans	NLT 30 days prior to flight test
0	SRAM/LEAP	Flight Test Reports	NLT 30 days after test
0	SRAM/LEAP	Environmental Compliance Documents	as required

G. (U) RELATED ACTIVITIES:

0	1216	Sea-Based Theater-Wide Defense	PE No. 0603216C
0	1504	Materials and Structures Technology	PE No. 0603217C
0	1201	Miniaturized	
0		Integration Technology and Validation	PE No. 0603217C
0		Facilities Support	PE No. 0603217C

There is no unnecessary duplication of effort within BMDO or the DoD.

H. (U) OTHER APPROPRIATION FUNDS: None

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Foreign Disclosure Guidelines completed March 1, 1991

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Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

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J. (U) MILESTONE SCHEDULE:

0	MSTI SCOUT- 1 Launch	1Q/FY93
0	MSTI SCOUT- 2 Launch	2Q/FY94
0	MSTI - 3 Launch	3Q/FY94
0	Perform SRAM/LEAP F-15 captive carry test	3Q/FY94
0	Perform SRAM/LEAP interstage validation Flight test	3Q/FY94
0	Perform SRAM/LEAP 3rd state controllability Flight test	4Q/FY94
0	Perform SRAM/LEAP "full-up" intercept rehearsal	1Q/FY95
0	Perform SRAM/LEAP intercept of TBM target from B-52	2Q/FY95
0	Perform SRAM/LEAP intercept of TBM target from F-15C	4Q/FY95

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C  
PE Title: Ballistic Missile Defense (U)

Project Number: 1204  
Budget Activity: 03  
Advanced Technology  
Development (U)  
February 1994

A. (U) RESOURCES: (\$ in Thousands)  
Project Title: Interceptor Studies and Analysis

Program Name: 0603217C RDT&E	FY1993 Actual	FY1994 Estimate	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	Total Program Completed
	7,500	6,115	0	0	0	0	0	0

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) This project funds technical and engineering resources required by Government Program Managers to plan and conduct technology investigation programs within the Interceptor Technology Directorate. Resources are used to perform analyses, develop innovative concepts in the particular technologies, plan and implement major experiments, perform data reductions and analysis of experiment results, and perform system engineering studies on interceptor technology concepts. Technical and engineering support is provided to all phases of interceptor technology program design, development, and test, including systems requirements/concepts definition, systems engineering and design, flight test planning and conduct, and range and on-orbit operations.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

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Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1204  
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C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1993 Accomplishments:

- o (\$0.455) Continued systems engineering and technical assistance efforts in support of identification, analysis, development, and testing of advanced kinetic energy interceptor components and subsystems.
- o (\$2.133) Continued support of technical feasibility decisions and interceptor technology advanced program planning through the use of engineering analysis and simulation of interceptor components integration technologies, and systems.
- o (\$4.912) Continued technical support in all areas of design, development, and test of the LEAP, SRAM/LEAP, MSTI, Navy LEAP, AIT, and ADI Programs.

(U) FY 1994 Plans:

- o (\$0.306) Continue systems engineering and technical assistance efforts in support of identification, analysis, development, and testing of advanced kinetic energy interceptor components and subsystems, including D2 and Communications Technology efforts.
- o (\$1.905) Provide in-depth technical comparisons and research of emerging technologies; analyze architectural changes and determine interceptor technology development requirements; continue support of technical feasibility decisions and interceptor technology advanced program planning; (\$3.904) Plan, in detail, and provide technical support to all phases of ground and flight experiments for the Navy LEAP, SRAM/LEAP, MSTI, AIT, and ADI programs.

(U) FY 1995 Plans:

- o No Funding

(U) Program Plan to Completion: This is a continuing program.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C  
PE Title: Ballistic Missile Defense (U)

Project Number: 1204  
Budget Activity: 03  
Advanced Technology  
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D. (U) WORK PERFORMED BY:

- o Analytic Services, Inc. (ANSER) - Arlington, VA.
- o Coleman Research Corporation (CRC) - Fairfax, VA.
- o Science Applications International Corporation (SAIC) - McLean, VA.
- o Science and Technology Associates, Inc. (STA) - Arlington, VA.
- o Integrated Systems, Inc. (ISI) - Santa Clara, CA.
- o Aero Thermo Technology, Inc. (AT2) - Huntsville, AL.
- o HJ Ford Associates Incorporated (HJF) - Arlington, VA.

E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

- 1. TECHNICAL CHANGES: None
- 2. SCHEDULE CHANGES: None
- 3. COST CHANGES: None

F. (U) PROGRAM DOCUMENTATION: None

G. (U) RELATED ACTIVITIES:

- o 1201 Interceptor Component Tech PE No. 0603215C
  - o 1202 Interceptor Integration Tech PE No. 0603217C
  - o 1208 Discriminating Interceptor PE No. 0603215C
  - o 1209 ENDO Atmospheric Interceptor Tech PE No. 0603215C
  - o 1212 D-2 Program PE No. 0603217C
  - o 1216 Sea-Based Theater-Wide Defense PE No. 0603216C
  - o 1405 Communications Eng Tech PE No. 0603215C
- There is no unnecessary duplication of effort within BMDO or the DoD.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1204  
Budget Activity: 03  
Advanced Technology  
Development (U)  
February 1994

H. (U) OTHER APPROPRIATION FUNDS: None

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

J. (U) MILESTONE SCHEDULE:

0	Exercise Contract Option	3Q/FY94
0	Exercise Contract Option	3Q/FY95
0	Exercise Contract Option	3Q/FY96

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C

PE Title: Theater Missile Defenses (U)

Project Number: 1206  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

A. (U) Resources: (\$ in Thousands)  
Project Title: Advanced TMD Weapons

	FY1993	FY1994	FY1995	FY1996	FY1997	FY1998	FY1999	Total
Program Name:	Actual	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Program
0603216C RDT&E	6,100	0	0	0	0	0	0	Completed

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) The Electro Thermal Chemical (ETC) Launcher technology project is exploring the feasibility of using a combination of electrical and chemical energy sources to produce hypervelocities. This work is underway at the Soreq Nuclear Research Center (SNRC) under the provisions of the Memorandum of Understanding between the U.S. Government and the Government of Israel, dated 6 May 1986. The approach taken by the Propulsion Physics Laboratory at SNRC combines electrothermal technology and conventional ballistics technology in a conventional gun in a mode that will result in high projectile velocities and relatively small amounts of electrical energies. This combination promises an acceleration process that will enable the achievement of velocities above the conventional ballistics limit, and a cost effective system that does not require huge quantities of electrical energy. The ultimate goal is to produce an ETC Launcher which will be able to launch (approximately 6 kg) guided projectiles at (approximately 2.5 km/s) to meet TMD requirements.

(U) Phase I of the program investigated the ignition of chemical propellants using high temperature plasma injectors. Initial tests using a 60mm ETC gun demonstrated the launch of a 1 kg mass at 2.0 km/s. Scaling techniques were used to test this ETC approach in a 105mm gun which accomplished the goal of launching a 1.5 kg projectile to 2.5 km/s. The 60mm and 105mm tests demonstrated a 15.6% and 9% improvement over conventional ballistics, respectively.

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## FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C

PE Title: Theater Missile Defenses (U)

Project Number: 1206

Budget Activity: 03

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February 1994

(U) The follow-on program's goal was to launch weapon size projectiles (approximately 6kg) at velocities (approximately 2.5 km/s) applicable for TMD. To keep the barrel length reasonably short, a 35% improvement of the ETC process over conventional ballistics was required. To reach required muzzle energies, it was necessary to scale-up the barrel diameter from 105mm to 120-155mm. A series of field experiments were also planned. The purpose was to bring the gun system technologies (D-2 like projectile, Soreq ETC Launcher, fire control) out of the laboratory and into the field. The first series of integrated field experiments (beginning in 4QFY93) demonstrated the ability to launch a D2-like aeroshell from an ETC Launcher with transportable power and fire control tracking of the projectile.

(U) Additional subtasks included strategic and theater missile defense integration studies to analyze the threat and to develop appropriate TMD missions and flow-down requirements to major hypervelocity electric launcher weapon subsystems. The results would have been used to guide development and demonstration planning, fire control conceptual design and development, and critical technical issue resolution appropriate for hit-to-kill, gun-launched, hypervelocity projectiles.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

### C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

#### (U) FY 1993 Accomplishments:

- o (\$2,500) Complete development of prototype fire control radar
- o (\$2,300) Fire 4-5 kg at 1.8-2.0 km/sec from Soreq 105mm ETC Launcher
- o (\$0,200) Increase ETC plasma injector performance to 3 megajoules at 1.5 gigawatts.
- o (\$1,000) Launch D2-like aeroshell containing electronics, battery and transmitter from Soreq 105mm launcher on the range with fire control tracking of the projectile

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C

PE Title: Theater Missile Defenses (U)

Project Number: 1206  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

o (\$0,100) Complete HVL TMD system study and final report

(U) FY 1994 Plans:

o Program terminated due to reductions in BMDO funding.

(U) Program to Completion: This program has been cancelled.

D. (U) WORK PERFORMED BY:

o Soreq Nuclear Research Center - Israel  
o Technology Applications - Placentia, CA  
o Georgia Tech Research Institute - Marietta, GA  
o BDM - Huntsville, AL  
o GE Aerospace - Huntsville, AL and Blue Bell, PA

E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

1. TECHNICAL CHANGES: Program has been terminated.
2. SCHEDULE CHANGES: Program has been terminated.
3. COST CHANGES: Program has been terminated.

F. (U) PROGRAM DOCUMENTATION:

o BMDO Program Management Agreement  
o Cost performance reports, program plans, HVL TMD Cost Analysis Requirements Document, and various technical reports

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C

PE Title: Theater Missile Defenses (U)

Project Number: 1206  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

G. (U) RELATED ACTIVITIES:

- o 2212 Corps SAM
- o 2209 ACES

PE No. 6.3  
PE No. 6.3

There is no unnecessary duplication of effort within BMDO or the DoD.

H. (U) OTHER APPROPRIATION FUNDS: None

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Cost Share Contract with Israel to develop ETC Launcher for TMD applications. Phase I was signed on May 2, 1989, and completed in June 1992. Follow-on contract for same effort commenced September 3, 1992.

J. (U) MILESTONE SCHEDULE:

- o Program has been terminated.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C  
PE Title: Ballistic Missile Defense (U)

Project Number: 1208  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

A. (U) RESOURCES: (\$ In Thousands)

Project Title: Discriminating Interceptor

	FY1993	FY1994	FY1995	FY1996	FY1997	FY1998	FY1999	Total
<u>Program Name:</u>	<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Program</u>
0603217C RDT&E	174	0	0	0	0	0	0	Completed

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) To achieve a high probability of kill of midcourse targets, interceptors must be capable of discriminating between real targets, in the presence of decoys and debris during the exo-atmospheric portion of flight. The interceptor must be lightweight and must be able to kinematically engage a full range of threats. To perform discrimination at sufficient range to implement guidance commands requires fusion of multi-spectral passive and ladar data to capitalize on available discriminants. Processors able to support the large computational demand, and high thrust divert are needed while staying within cost and weight constraints.

(U) The objective of the ADI program is to develop and demonstrate interceptor components that, when integrated, will provide onboard discrimination capability. The original intent of this program was to design and demonstrate critical components for a discriminating interceptor including active/passive seekers (ladar/LWIR, rapid beam steerers, signal and data processors, discrimination algorithms, data fusion algorithms, and high acceleration divert propulsion. Additionally, an advanced vehicle concept (AVC) design, traceable to GBI requirements, was to be completed and maintained as the technology development progressed. Components were to be ground and flight tested as they became available. The program was planned to culminate with dedicated flight testing of a discriminating interceptor technology test vehicle (TTV). Due to severe budget cuts, the ADI program was tailored to focus on development and demonstration of the ladar only. The ADI funds were provided through PMA A2202. The PMA 1208 effort

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1208  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

focused on development of discrimination algorithms and neural networks to support active/passive data fusion and target selection.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

C. (U) PROGRAM ACCOMPLISHMENT AND PLANS:

(U) FY 1993 Accomplishments:

o (\$24K) Identified discrimination algorithms required.  
o (\$75K) Began formulation of discrimination algorithms.  
o (\$75K) Began implementation of discrimination algorithms in neural networks.

(U) FY 1994 Plans: None

(U) FY 1995 Plans: None

(U) Program Plan to Completion: This is a zero funded program.

D. (U) WORK PERFORMED BY:

o AEDAR - Rockville, MD

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C  
PE Title: Ballistic Missile Defense (U)

Project Number: 1208  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

E. (U) COMPARISON WITH FY 1994 DESCRIPTION SUMMARY:

1. TECHNICAL CHANGES:

2. SCHEDULE CHANGES:

3. COST CHANGES: Program terminated due to zero budget.

F. (U) PROGRAM DOCUMENTATION:

o Program Management Agreement (PMA 1208), Jan 07, 1992; October 1993

G. (U) RELATED ACTIVITIES:

(U) The ADI effort PE No. 0603215C (Limited Defense System) Project 1208 will benefit from developments in Interceptor Component Technology (PE No. 0603217C, Project 1201). The discriminating interceptor will incorporate any of the following technologies that prove to be useful to an NMD Block Upgrade: focal plane array and readout electronics, ladars, beam steering, optics, signal processors, sensor/data fusion algorithms, discriminating algorithms, inertial measurement units, and propulsion.

H. (U) OTHER APPROPRIATION FUNDS: None

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

J. (U) MILESTONE SCHEDULE:

o Identified discrimination algorithms required	2Q/FY93
o Began formulation of data fusion and discrimination algorithms	3Q/FY93
o Began implementation of algorithms in neural nets	3Q/FY93

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1209  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

A. (U) RESOURCES: (\$ In Thousands)  
Project Title: Endo-Atmospheric Interceptor Technologies

Program Name: 0603217C RDT&E	FY1993		FY1994		FY1995		FY1996		FY1997		FY1998		FY1999		Total	
	Actual	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Program	Completed
	22,910	2,500	0	0	0	0	0	0	0	0	0	0	0	0	0	0

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) The Endo-Atmospheric Interceptor Technologies Program is a comprehensive approach to coordinate the development and demonstration of advanced components critical for small, lightweight (<20KG) high velocity (4km/s) interceptors. The aero-thermal and aero-optical issues associated with hyper velocity flight in the atmosphere are being resolved. Advanced window materials and cooling techniques are being developed and tested. This enables interceptor velocity, lethality and overall performances to exceed the current low velocity interceptor flight capability. These technologies will provide the basis for strategic and tactical ballistic missile interceptors and Boost Phase Interceptors operating within the atmosphere.

(U) The project includes the development, evaluation and test of innovative active and passive seeker concepts and aperture concepts through Broad Agency Announcements (BAA). The BAA efforts are managed for BMD0 by the US Army Strategic and Space Defense Command, Huntsville, AL, and the Naval Air Warfare Center, China Lake, CA. These seeker and aperture concepts will be tested in the Aero Optical Evaluation Center (AOEC) developed by BMD0 for this purpose.

(U) The Monolithic Interceptor Technology Program began in FY92 with BAA contract awards late in FY92 and in FY93. The purpose of the program is to develop next generation endoatmospheric vehicle technologies to achieve revolutionary size/weight reductions, enable multi-service mission flexibility, and support multi-service mission flexibility, and support multi-spectral/dual mode seeker operation.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C  
PE Title: Ballistic Missile Defense (U)

Project Number: 1209  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

(U) Through the efforts of two prime contractors, using appropriate component technology from the BAAs and other sources, this project will develop and demonstrate miniaturized endoatmospheric interceptor testbed vehicles for strategic tactical and boost phase missile defense. The miniaturized experimental vehicle will have self-contained autonomous guidance, jet reaction or aerodynamic control, optical or radar seekers and will be capable of hit-to-kill (HTK) with aim point selection accuracy.

(U) The component technologies developed will provide block upgrade options to current ERINT or Patriot concepts, enhanced THAAD performance capabilities, and enabling technologies for CORPS SAM, Navy TMD, and Boost Phase Interceptor. Aimpoint selection and minimum vehicle response time will provide assured endo-atmospheric Hit-to-Kill performance, making the interceptor more responsive to advanced threats. RF components developed within this effort will replace current TWT technologies at 35 and 94 GHz operating frequencies with high power solid state devices, significantly reducing interceptor size and weight and improving seeker accuracy, eliminating need for a warhead.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1993 Accomplishments:

- o (\$13.51M) Begin fabrication of AIT seeker and aperture components for two EO and one RF seeker.
- o (\$4.700M) Five BAA Technology advance windows concepts have been fabricated and successfully Thermal tested at AEDC ARCJET.
- o (\$4700M) Demonstrate Ku and W band T/R Modules, antenna and beam steering.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1209  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

- (U) FY 1994 Plans:  
o (\$1.500M) Begin Fabrication of ENDO AIT seekers.  
o (\$ .700M) Test ENDO LEAP aperture components at AOEC.  
o (\$ .300M) Demonstrate medium power 35Ghz Impatt amplifier.

- (U) FY 1995 Plans: Work Transferred to Project 1215.

D. (U) WORK PERFORMED BY:

ENDO Atmospheric Interceptor Technology

- o Lockheed Missile and Space Company - Huntsville, AL.  
o McDonnell Douglas Aerospace - Huntington Beach, CA.

E/O and MMW Seeker/Aperture Technology

- o Applied Research Associates - Huntsville, AL.  
o Aerojet -Sacramento, CA.  
o BDM - Huntsville, AL.  
o LMSC, Huntsville, AL.  
o Irvine Sensors, Irvine, LA.  
o Loral - Lexington, MA.  
o LTV - Dallas, TX.  
o Raytheon - Lexington, MA.  
o Rockwell - Thousand Oaks, CA.  
o Textron - Wilmington, MA.  
o Westinghouse - Baltimore, MD.

Dual Mode (MMW/IR)

- o Aero Thermal Systems & Structures - Temecula, CA.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

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- o Rockwell - Anaheim, CA.

Monolithic Technologies

- o ATSS (Sparta) - Temecula, CA.
- o Gencorp Aerotec - Sacramento, CA.
- o USAF Phillips Laboratory - Kirtland AFB, NM.
- o Raytheon - Lexington, MA.
- o Sparta - San Diego, CA.
- o Sensor Systems Group - Waltham, MA.
- o Textron - Wilmington, MA.

E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

1. TECHNICAL CHANGES:

2. SCHEDULE CHANGES: Flight test slipped 9 months.

3. COST CHANGES:

F. (U) PROGRAM DOCUMENTATION:

- o Atmospheric Interceptor Technology Kickoff Meeting, July 1992
- o AIT PHASE II Technical Interchange Meeting July 1993.

G. (U) RELATED ACTIVITIES:

(U) This project is closely related to Project 3300 which is supplying the ground test facilities for test of the seekers/apertures, and experimental vehicles. As the components and experimental vehicles are ready for flight test, they will use the flight test services project for boosters, targets, and range operations. Projects 1215 Ascent/Boost Phase Technology, 1216 Navy Sea Based TMD, 2209 Arrow/Aces,

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## FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1209

Budget Activity: 03

Adv Technology Dev (U)

February 1994

2210 THAAD, 2212 Corps SAM, and 2213 Sea Based TMD INT will benefit from the development and test of the endoatmospheric interceptor technology. There is no unnecessary duplication of effort within BMD0 or the DOD.

H. (U) OTHER APPROPRIATION FUNDS: None

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

J. (U) MILESTONE SCHEDULE:

0	Fish Eye Variant Window/Aperture Design	2Q/FY92
0	SMART Window Microoptics Fabrication Eval Complete	2Q/FY92
0	Internally Cooled Window Detailed Design Completed	2Q/FY92
0	Micro Lens Window Detail Design Completed	2Q/FY92
0	Multifaceted Dome, Facet Coupon Tests	3Q/FY92
0	Multifaceted Dome #1 Fabricated	3Q/FY92
0	Enhanced Aperture Model Delivered to AEDC	3Q/FY92
0	Thin Window Concept Selection	3Q/FY92
0	Fast Framing IC, 64 Channel, Output at 1KHz	3Q/FY92
0	Recessed Window Design Completed	3Q/FY92
0	ENDO LEAP PDR (Select Phase II Contractor[s])	3Q/FY92
0	MOSAIC Window Conical Design Complete	4Q/FY92
0	Multifaceted Dome AEDC Arc Jet Tests	4Q/FY92
0	Enhanced Aperture Model Delivered to Lens	4Q/FY92
0	Diamond Window Optimum Deposition Process Selection	4Q/FY92
0	Micro Lens Window Fabrication Completed	4Q/FY92
0	Internally Cooled Window Test Article Complete	4Q/FY92
0	Diamond Window Optimum Coating Process Selection	1Q/FY93

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## FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1209  
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0	Thin Window Model Fabrication Completed	1Q/FY93
0	Recessed Window ARCJET Testing Completed	1Q/FY93
0	Fast Frame Seeker Testing Completed	2Q/FY93
0	Complete E/O and MMW Seeker/Aperture ARCJET Experiments	2Q/FY93
0	Solid Divert Throttle Ability Demonstration	1Q/FY94
0	Advanced FPA Deliverables	4Q/FY94
0	ENDO AIT Seeker Aperture AOEC Testing	4Q/FY94
0	Steering Mirror	1Q/FY95
0	DEWAR Assembly Deliveries	1Q/FY95
0	Seeker, Seeker Aperture and Forebody Thermal at AEDC ARCJETS	1Q/FY95
0	Complete ENDO LEAP Seeker Tests	3Q/FY95
0	Form, Fit and Function Seeker AOEC Testing	1Q/FY95
0	IR window materials evaluation flight test	4Q/FY95
0	Seeker Image Stabilization Tests	3Q/FY95
0	Seeker/IMU Hardware-in-the-LOOP Tests	4Q/FY95
0	Environmental (Shock & Vibration) Testing of AIT SEEKERS	4Q/FY95

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FY1994 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1212  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

A. (U) RESOURCES: (\$ In Thousands)  
Project Title: D-2 Program

	FY1993	FY1994	FY1995	FY1996	FY1997	FY1998	FY1999	Total
<u>Program Name:</u>	<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Program</u>
0603217C RDT&E	9,800	4,600	0	0	0	0	0	Completed

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) This project will demonstrate the launch of a guided interceptor (D-2) from a hypervelocity launcher (HVL) with associated fire control to demonstrate the potential of a HVL system as a candidate weapon system for Theater Missile Defense (TMD) in the near term and other longer range applications in the far term. This involves the development of the Gee-hardened D-2 projectile which is a command guided to terminal homing interceptor.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

C. (U) PROGRAM ACCOMPLISHMENT AND PLANS:

(U) FY 1993 Accomplishments:

o (\$8,000K) Demonstrated ability of full scale D2 aeroshell and electronics to survive

o HVL launch process at 65 KGees

o (\$600K) Demonstrated ability of D2 sabot to survive HVL launch process and separate clearly from D2 aeroshell upon exit

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FY1994 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C  
PE Title: Ballistic Missile Defense (U)

Project Number: 1212  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

- o (\$400K) Demonstrated ability of interferometric fire control to skin track the D2 interceptor
- o (\$800K) Operationally verified D2 transmitter and fire control interface
- (U) FY 1994 Plans:
  - o (\$700K) Verify performance of D2 transceiver in flight with fire control
  - o (\$3,600K) Assess performance of solid propellant control system in a limited duty cycle mode
  - o (\$300K) Fire control track of maneuvering D2 on the range

(U) FY 1995 Plans:  
o Unfunded

(U) Program Plan to Completion: This program is zero funded in FY95 and beyond.

D. (U) WORK PERFORMED BY:

o Martin Marietta - King of Prussia, PA.

E. (U) COMPARISON WITH FY 1993 DESCRIPTION SUMMARY:

- 1. TECHNICAL CHANGES: None
- 2. SCHEDULE CHANGES: None
- 3. COST CHANGES: None

F. (U) PROGRAM DOCUMENTATION:

- o Report to Congress - yearly
- o D-2 Guided Projectile Reviews - quarterly

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FY1994 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1212  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

- G. (U) RELATED ACTIVITIES: None
- H. (U) OTHER APPROPRIATION FUNDS: None
- I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None
- J. (U) MILESTONE SCHEDULE:
- |   |   |         |
|---|---|---------|
| 0 | Field test maneuvering D2 from HVL with F/C     | 3Q/FY94 |
| 0 | Field test maneuvering D2 with IMU from HVL     | 4Q/FY95 |
| 0 | Begin Command Guided D-2 Testing                | 4Q/FY96 |
| 0 | Begin closed loop intercepts of target vehicles | 4Q/FY97 |

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1214  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

A. (U) RESOURCES: (\$ in Thousands)

Project Title: Advanced Interceptor Technology (AIT) Program  
(formerly Brilliant Pebbles (BP))

	FY1993	FY1994	FY1995	FY1996	FY1997	FY1998	FY1999	Total
<u>Program Name:</u>	<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Program</u>
0603217C RDT&E	207,279	15,000	0	0	0	0	0	Completed

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) Project 1214 within this PE funds the Advanced Interceptor Technology (AIT) program. The Brilliant Pebbles (BP) program, that was funded in the Space-Based Interceptor (subsequently proposed for elimination in the FY95-FY99 POM guidance) program element developed the primary technology in the AIT program. This effort encompassed demonstrating key space interceptor and satellite technologies, based on system requirements and designs, and performing risk reduction.

(U) The Advanced Interceptor Technology Program started to take advantage of the components and technologies developed in the Brilliant Pebbles Program. Funding reductions preclude taking full advantage of this, and the AIT program is being terminated during FY 94. Prior to FY 94, activities for this project were funded out of project 2205.

(U) Hardware assets procured under the program will be presuded, where applicable under the NMD Technology Readiness Program and Follow-On Technology efforts.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of

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## FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1214

Budget Activity: 03

Adv Technology Dev (U)

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the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

### C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

#### (U) FY 1993 Accomplishments and Plans:

- o (\$97.403M) Prepared and conducted ground and flight tests.
- o (\$14.047M) Demonstrated low cost satellite manufacturing work cell technologies.
- o (\$47.965M) Developed segment designs.
- o (\$37.963M) Manufactured and integrated the first kinetic kill vehicle for flight test.
- o (\$ 9.901M) Program replanned to focus on Advanced Interceptor Technologies.

#### (U) FY 1994 Plans:

- o (\$15.000M) Fund program termination based upon zero funding in FY95-99.

#### (U) FY 1995 Plans: None

#### (U) Program Plan to Completion: Use funds in FY94 to conclude efforts.

### D. (U) WORK PERFORMED BY:

- (U) Lawrence Livermore National Laboratory (LLNL) developed the BP concept and accomplished initial component development. These results were passed to industry for technical advancement and testing. The Air Force AIT Program Office is currently executing the BP technology and concept demonstration with a two contractor team:
  - o TRW - Redondo Beach, CA (prime); (subs) Hughes - El Segundo, CA; Sparta - Laguna Hills, CA; Photon Research Assoc. - San Diego, CA; Mission Research Corp - Santa Barbara, CA

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## FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

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- o Martin Marietta Corp - Denver, CO (prime); (subs) MMC - Orlando, FL; Aerojet - Sacramento, CA; IBM - Manassas, VA; OCA - Garden Grove, CA

### E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

1. TECHNICAL CHANGES: Termination in FY94
2. SCHEDULE CHANGES: Termination in FY94
3. COST CHANGES: Termination in FY94

### F. (U) PROGRAM DOCUMENTATION:

- o Technical Requirements Document (TRD) for Brilliant Pebbles (BP) 7/91

### G. (U) RELATED ACTIVITIES:

- o 3300 Test & Evaluation Support PE No. 0603217C
  - o 4000 Segment Management/Operational Support PE No. 0603217C/  
PE No. 0603218C
  - o 1217 KKV Technology PE No. 0603217C
  - o 1216 Sea-Based Wide Area (LEAP) PE No. 0603216C
  - o 1502 Lethality PE No. 0603217C
  - o 2102 Brilliant Eyes (BE) PE No. 0604217C
- There is no unnecessary duplication of effort within BMD0 or the DoD.

### H. (U) OTHER APPROPRIATION FUNDS: None

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1214  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

J. (U) TEST AND EVALUATION DATA:

o BP Flight Experiments

FE-1

FE-2

FE-3

o HUNTER'S TROPHY Underground Test

4Q/FY90

3Q/FY91

1Q/FY93

4Q/FY92

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C/0603217C

PE Title: Theater Missile Defense/Ballistic Missile Defense (U)

Project Number: 1215  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

A. (U) RESOURCES: (\$ in Thousands)  
Project Title: Boost Phase Int / EXO

Program Name:	FY1993 Actual	FY1994 Estimate	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	Total Program Continuing
0603216C RDT&E	0	15,000	0	0	0	0	0	0
0603217C RDT&E	15,435	16,489	61,100	65,300	70,300	85,300	90,300	Continuing

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) The purpose of this project is to demonstrate via test follow-on technology developments as they apply to Boost Phase Intercept / Exoatmospheric Intercept (BPI/E) for Theater Missile Defense (TMD). The TMD threat cannot yet be countered by any single solution; it will require a balance of integrated attack operations, comprehensive active defense against enemy missiles in boost and flight phases, extensive passive measures, a robust C3I and a surveillance capability responsive to unique theater missile characteristics. Present BMDO/TMD architectures focus on midcourse and terminal defenses which allow fragments of the missile body and/or warheads to inflict damage on friendly areas. By adding BPI/E defensive layers, tremendous leverage can be brought to bear on the enemy to significantly reduce the utility of his theater ballistic missiles (TBM). During a TBM's boost phase the missile is readily visible, slow moving and extremely vulnerable. BPI of TBMs can cause missile debris to fall on enemy territory or fall far short of the intended target while Exoatmospheric Intercept BPI/E could negate threats post boost thus thinning out the number of TBMs exposed to subsequent defensive layers. Exoatmospheric Intercept BPI/E combined will reduce the burden on terminal defenses. Thus the goal is for a well-paced Exoatmospheric Intercept BPI/E advanced technology demonstration (ATD) program which will provide the foundation for later intercept options this decade. This will be accomplished via discrete test demonstrations focused on endo- and exo- integrated KKV's on manned and unmanned platforms.

(U) The Endo-Atmospheric Interceptor Technologies portion of this program is a comprehensive approach

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to coordinate the development and demonstration of advanced components critical for small, lightweight (<20kg) high velocity (4km/s) interceptors. It will develop and demonstrate miniaturized endoatmospheric interceptor testbed vehicles for tactical and boost phase missile defense. It addresses aero-thermal and aero-optical issues associated with hypervelocity atmospheric flight, advanced window materials, cooling techniques and the development, evaluation and test of active and passive seeker and aperture concepts.

(U) The Monolithic Interceptor Technology Program is to develop next generation endoatmospheric vehicle technologies to achieve revolutionary size/weight reductions, enable and support multi-service mission flexibility, and multi-spectral/dual mode seeker operation. Component technologies developed will provide block upgrade options to current ERINT or Patriot concepts, enhanced THAAD capabilities, and enabling technologies for CORPS SAM, Navy TMD, and Boost Phase Interceptor.

(U) This project, in FY93 and 94, was carried as KE Boost Phase Interceptor Technology project number 2106, program element 0603217C. In FY93 RAPTOR/TALON sensor development is accounted for under Project 1106 program element 0603217C.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1993 Accomplishments:

- o (\$3,500) Began low altitude flight test of the solar electric UAV (Pathfinder)
- o (\$7,800) Demonstrated pumped propulsion system on ground
- o (\$4,135) Began low altitude flight test of the gasoline powered UAV (RAPTOR Demonstrator)

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(U) FY 1994 Plans:

- o (\$9,500) Fly proof of principle high-altitude long-endurance (HALE) gasoline powered UAV (RAPTOR Demonstrator)
- o (\$4,800) Demonstrate miniaturized monopropellant pumped propulsion technology via flight test
- o (\$2,189) Achieve launch detection and tracking of a ballistic missile from an unmanned UAV
- o (\$15,000) Begin conceptual Exoatmospheric Intercept BPI/E planning; plan for possible SRAM/LEAP Test

(U) FY 1995 Plans:

- o (\$15,100) Continue HALE UAV flight tests with the addition of launch detection sensors
- o (\$15,000) Initiate design and development of Exoatmospheric Intercept BPI/E and BPI ATD hardware for use on manned and unmanned platforms
- o (\$17,400) Complete fabrication and test ENDO atmospheric seekers
- o (\$13,600) Continue conceptual planning for Exoatmospheric Intercept BPI/E; conduct SRAM/LEAP intercept

(U) Program Plan to Completion: This is a continuing Program.

D. (U) WORK PERFORMED BY:

(U) In-House:

- o Lawrence Livermore National Laboratory, CA
- o AF Phillips Lab; Kirtland AFB, NM
- o U.S. Army Strategic and Space Defense Command, AL
- o Naval Air Warfare Center, CA

(U) Contractors:

- o AeroVironment - Simi Valley, CA
- o Scaled Composites - Mojave, CA
- o Hughes Aircraft - Canoga Park, CA

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- o Rocket Research - Redmond, WA
- o McDonnell Douglas - Huntington Beach, CA
- o Lockheed - Sunnyvale, CA and Huntsville, AL
- o Applied Research Associates - Huntsville, AL
- o Aerojet - Sacramento, Ca
- o BDM - Huntsville, AL
- o Irvine Sensors - Irvine, LA
- o Loral - Lexington, MA
- o LTV - Dallas, TX
- o Raytheon - Lexington, MA
- o Rockwell - Thousand Oaks, CA
- o Textron - Wilmington, MA
- o Westinghouse - Baltimore, MD
- o Aero Thermal Systems & Structures - Temecula, CA
- o Rockwell - Anaheim, Ca
- o ATSS (Sparta) - Temecula, CA
- o Gencorp Aerotec - Sacramento, CA
- o Sparta - San Diego, CA
- o Sensor Systems Group - Waltham, WA

E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY: New descriptive summary incorporating Project 2106 and Project 1209 technical efforts. Project 2106 RAPTOR/TALON sensor efforts are addressed in Project 1106

1. TECHNICAL CHANGES: Exoatmospheric Intercept BPI/E effort initiated within this PE.
2. SCHEDULE CHANGES:
3. COST CHANGES: Due to FY94 budget reductions, endoatmospheric flight test slipped 9 months and BPI ATD slipped a minimum of 2 years; TALON portion of project slowed.

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Program Element: 0603216C/0603217C

PE Title: Theater Missile Defense/Ballistic Missile Defense (U)

Project Number: 1215  
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F. (U) PROGRAM DOCUMENTATION:

- o BMDO Program Management Agreement
- o Monthly Status Reports
- o Technical Interchange Meetings

G. (U) RELATED ACTIVITIES:

- |                                 |                         |
|---------------------------------|-------------------------|
| o 1209 Endo Tech                | PE No. 0603217C         |
| o 2207 Patriot                  | PE No. 0604216C         |
| o 2208 ERINT                    | PE No. 0604216C         |
| o 2210 THAAD                    | PE No. 0604216C         |
| o 2212 Corps SAM                | PE No. 0603216C         |
| o 1216 Sea based Wide Area Tech | PE No. 0063216C         |
| o 2209 Arrow/Aces               | PE No. 0603216C         |
| o 2213 Sea based TMD INT        | PE No. 0603216C/064216C |
- There is no unnecessary duplication of effort within BMDO or the DoD.

H. (U) OTHER APPROPRIATION FUNDS: None

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Separate BPI study with the state of Israel (PMA3205)

J. (U) MILESTONE

- |   |         |
|---|---------|
| o DEWAR Assembly Deliveries                               | 1Q/FY95 |
| o Seeker, Seeker Aperture and Forebody Thermal Deliveries | 1Q/FY95 |
| o Conduct SRAM/LEAP Intercept                             | 4Q/FY95 |
| o Complete ENDO LEAP Seeker Tests                         | 3Q/FY95 |

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PE Title: Theater Missile Defense/Ballistic Missile Defense (U)

Project Number: 1215  
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o IR window materials evaluation flight test	4Q/FY95
o Seeker Image Stabilization Tests	3Q/FY95
o Seeker/IMU Hardware-in-the-LOOP Tests	4Q/FY95
o Environmental (Shock & Vibration) Testing of AIT Seekers	4Q/FY95

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C

PE Title: Theater Missile Defense (U)

Project Number: 1216  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

A. (U) RESOURCES: (\$ in Thousands)

Project Title: Sea-Based Wide Area Defense

Program Name: 0603216C RDT&E	FY1993	FY1994	FY1995	FY1996	FY1997	FY1998	FY1999	Total
	Actual	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Program
	31,500	80,000	17,725	30,590	33,400	36,510	39,145	Continuing

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) The Secretary of Defense's Bottom-Up Review (BUR) of FY94 identified Sea-Based Wide Area Defense (TBMD) as a high payoff advanced concept that builds on the core major acquisition program for TBMD (AEGIS/SM2 Block IV A) (Project 2213) and the existing infrastructure of AEGIS ships. This program establishes sea-based theater capability using an upper tier interceptor and AEGIS weapons system program, under Theater Missile Defense in FY94. The Lightweight Exoatmospheric Projectile (LEAP) technology demonstration program originated under Project 1202. These efforts provided the critical technology integration and testing needed to support the first phase of this TMD demonstration program. The entire LEAP technology demonstration program consolidated under Project 1210 in FY94.

(U) Funding in Project 1216 in FY94 includes the baseline funds for the sea based theater program including those activities necessary to proceed through a Milestone 0 to a Milestone I. Such activities include support of an independent cost and operational effectiveness analysis (COEA), THAAD/AEGIS compatibility studies, operational mode studies, and interceptor safety/system engineering efforts. This program will build on the TERRIER/LEAP technology demonstration efforts to date and will provide for the final fully integrated intercept at sea. In order to minimize cost, reduce risk, and enable early demonstration, maximum use will be made of existing hardware, test facilities, test infrastructures, and procedures. Early tests performed using deployed extended range missile systems (Terrier) in Phase I will transition to STANDARD missile BLK IV with the AEGIS weapons system in the Phase II AEGIS Advanced Technology Demonstrations (ATDs).

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(U) Funding under Project 1210 in FY94 provides for the development, independent government testing, and experimental integration of state-of-the-art component technology to provide risk reduction for systems that could be deployed prior to the beginning of the twenty-first century. The project includes further development of Lightweight Exo-Atmospheric Projectiles (LEAP) and their technologies, and planning for transition of the LEAP technologies into the Theater Missile Defense Program. Funding under this program provides for continued LEAP flight testing at Wallops Flight Facility and the Naval Air Warfare Center (NAWC/MPNS) at Point Mugu, CA. Funding under this program also provides for development of advanced LEAP integrated technologies, and advanced LEAP test planning for potential weapon system applications, including SRAM/LEAP technology demonstrations and PATRIOT/LEAP compatibility testing.

(U) Funding under Project 1210 further provides for the planning and testing which could provide a low-cost, low-risk, demonstrated technology insertion option, based on LEAP interceptor technologies, using existing STANDARD missile systems. This will provide a comprehensive demonstration of technology in support of developing an effective, near-term exoatmospheric sea based theater missile defense capability. The program will perform a series of suborbital flight tests of Navy STANDARD missiles with increasingly challenging mission scenarios which will validate the capability of LEAP technologies to perform exoatmospheric intercepts of theater missile type targets. A step-by-step approach will be used to demonstrate all the necessary elements of a sea-based TMD system: exo-interceptors, boosters, sustainers, kick stages, shipboard launch systems, fire control systems, and satellite cueing capability. The program will culminate in a series of realistic, fully integrated intercepts at sea.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

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C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1993 Accomplishments:

(\$31,500) LEAP Technology Demonstration and Studies

o Continued Phase I of LEAP technology demonstrations using Terrier missiles.

o Performed successful Terrier missile flight test demonstrating modified removable shroud, ejection of inert KKV, improved ship system fire control mods, and measurement of missile flight environments (FTV-2).

o Initiated planning for COEA using an independent agency (Center for Naval Analysis).

o Initiated initial studies leading to concept definition.

o Initiated planning for an integrated sea based theater program starting in FY94.

(U) FY 1994 Plans:

Under Project 1210:

(\$34,000) Navy Technology Validation Flights

o Complete safety certification of SM-2/LEAP interceptor for shipboard test.

o Perform complete mission rehearsal test for intercept of TMD type target from shipboard launch platform (FTV-3). Includes incorporation of off-board sensors and complete weapon system integration.

o Perform operational concept demonstration by performing fly by of TBM representative target with upper tier interceptor from Terrier ship at sea (FTV-4).

o Plan for the execution of a high altitude controllability demonstration of SM2 Block IV missile from AEGIS ship at sea.

(\$13,000) Provide projectiles and midcourse interceptor components for series of flight tests using STANDARD missile elements.

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(\$12,600) Mission Operations Checkout

- o Validate mission trajectory, guidance accuracy and fire control solution of Terrier LEAP target in Target Demonstration flight.
- o Demonstrate means of passing target track information (range radar and space sensor) to ship firing platform.
- o Perform SRAM/LEAP operational concept demonstrations for ascent phase interceptors validating the capability to uplink fire control information to the missile interstage and the ability to separate and control the midcourse interceptor (LEAP/Interstage/ASAS) through exoatmospheric flight.

(\$5,500) Advanced Propulsion Development and Demonstration

- o Provide advanced propulsion systems for integration into the Terrier/LEAP interceptor.
- o Complete preprototype design and test of an alternate solid divert configuration.
- o Hover test second configuration solid divert propelled LEAP interceptor.

(\$1,900) Provide mission support for sea-based launched interceptor flight tests.

- o Provide target and range support and planning for the testing of an upper tier interceptor launched from a ship at sea against a TBM representative target.

Under Project 1216:

(\$4,600) Sea-Based Wide Area Defense Program

- o Initiate cost and operational effectiveness analysis (COEA) and supporting studies.
- o Complete concept definition analysis.
- o Complete initial ORD development.
- o Solicit innovative/additional input from industry for consideration in the COEA.
- o Initiate planning for AEGIS/LEAP technology demonstration.
- o Continue AEGIS/THAAD compatibility studies.
- o Continue to support engineering tradeoffs and studies.

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Program Element: 0603216C

PE Title: Theater Missile Defense (U)

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- o Prepare for sea-based theater-wide Milestone.
- o Initiate BMC3 analyses for sea based theater defense.

(U) FY 1995 Plans:

(\$1,000) Navy Technology Demonstration/Validation Program

- o Complete analysis and closeout of Terrier LEAP flight test program paving the way for an advanced AEGIS operational system demonstration.

(\$16,725) Sea-Based Wide Area Defense Planning and Studies

- o Continue COEA/THAAD compatibility studies and evaluation of advanced technologies.
- o Continue BM/C3 studies and demonstrations for sea-based Wide Area Defense defense
- o Conduct AEGIS/LEAP Standard missile engineering for the Sea-Based Wide Area Defense program.

(U) Program Plan to Completion: The FY95-FY99 program focuses on the priorities identified in the BUR and is structured to take advantage of the TERRIER/LEAP efforts, as well as the Sea-Based Wide Area TBMD project (AEGIS/SM-2 Block IVA) (PN 2213) to provide for a fully integrated Sea-Based Wide Area Defense intercept capability.

D. (U) WORK PERFORMED BY:

(U) In-House:

- o Naval Air Warfare Center, Weapons Dep - White Sands Missile Range, NM (WSMR) and Pt. Mugu, CA
- o AF Phillips Laboratory - EAFB, CA and Hanscom AFB, MA
- o Naval Surface Warfare Center - Dahlgren, VA
- o Naval Surface Warfare Center - Pt. Hueneme, CA
- o Johns Hopkins University, Applied Physics Lab - Baltimore, MD
- o STANDARD Missile Program Office - Arlington, VA
- o Terrier Program Office - Arlington, VA

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- o AEGIS Program Office - Arlington, VA
- o Navy Program Executive Office (Theater Air Defense) - Arlington, VA
- o US Army Space and Strategic Defense Command (USASSDC) - Huntsville, AL

(U) Contractor:

- o Hughes Missile Systems Company - Canoga Park, CA
- o Boeing Aircraft Company - Seattle, WA
- o Rocketdyne Div. Rockwell International - Canoga Park, CA
- o ANSER Corp. - Arlington, VA
- o Thiokol Corp. - Elkton, MD
- o Hughes Missile Systems Company - Pomona, CA
- o Raytheon Corp. - Bedford, MA
- o Aerojet Corp. - Sacramento, CA

E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

1. TECHNICAL CHANGES: Technical efforts were structured to obtain maximum leverage for the follow-on program from applicable technology demonstrations and Sea-Based Wide-Area Defense TBMD program (PN 2213) activities.
2. SCHEDULE CHANGES: Program restructured to support Sea-Based Wide-Area Defense as a TMD program.
3. COST CHANGES: Funding for FY94-FY99 will support transition from advanced technology development to acquisition of a Sea-Based Wide-Area Defense TBMD capability.

F. (U) PROGRAM DOCUMENTATION:

- o LEAP technology demonstration MOU - 12/91
- o LEAP technology demonstration program plan - 8/92

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- o Treaty Compliance Certification - 8/92 and as necessary
- o LEAP technology demonstration flight test plans - 9/92, 9/93, 6/94, 8/94
- o LEAP technology demonstration flight test reports - NLT 30 days, after test
- o Navy LEAP technology demonstration EA/FONSI - 9/92
- o LEAP EA/FONSI - 6/91
- o LEAP treaty certification - 8/91
- o LEAP flight test mission requirements documents - 11/93

G. (U) RELATED ACTIVITIES:

- o 1202 Interceptor Integration
- o 1504 Materials and Structures Technology
- o 2213 Sea-Based Wide-Area Defense TBMD

There is no unnecessary duplication of effort within BMDO or the DoD.

PE No. 6.3  
PE No. 6.3  
PE No. 6.4

H. (U) OTHER APPROPRIATION FUNDS: None

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Foreign Disclosure Guidelines in progress.

J. (U) MILESTONE SCHEDULE:

- o Conducted kinematic and controllability flight test #1
- o Conduct kinematic and controllability flight test #2
- o Conduct FTV #3 full-up targeting rehearsal
- o Conduct FTV #4 mission target fly by
- o Perform High Alt Block IV/AEGIS controllability test
- o Conduct FTV #5 high-speed intercept of TMD target
- o Perform AEGIS LEAP nosecone and KKV ejection flight test

4Q/FY92  
4Q/FY93  
4Q/FY94  
4Q/FY94  
4Q/FY94  
2Q/FY95  
2Q/FY95

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0	Perform AEGIS LEAP 3rd stage separation and controllability fight test	4Q/FY95
0	Perform missile engagements of independent TMD targets (non RV)	1Q/FY96
0	Perform AEGIS LEAP full-up intercept rehearsal flight-test	1Q/FY96
0	Perform missile engagements of independent TMD targets (RV)	2Q/FY96
0	Complete Wide Area Defense capability advanced technology demonstrations and prepare for other follow-on activities as necessary	2Q/FY96

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Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1217  
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A. (U) RESOURCES: (\$ in Thousands)  
Project Title: KKV Technology

	FY1993	FY1994	FY1995	FY1996	FY1997	FY1998	FY1999	Total
<u>Program Name:</u>	<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Program</u>
0603217C RDT&E	81,338	57,200	120,000	113,000	111,000	125,000	126,000	Continuing

B. BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) The objective of the Kinetic Kill Vehicle (KKV) Technology effort is to design, fabricate, ground test, and flight test state-of-the-art KKV technology which can accomplish hit-to-kill (non-nuclear) intercepts of Intercontinental Ballistic Missile (ICBM) and Submarine Launched Ballistic Missile reentry vehicles (RVs) in the midcourse of their trajectories. Midcourse sensors will acquire, track, and pass threat cluster information to the Command and Control Element, which will cue the interceptors and provide updates if they are available. Using onboard sensors, the interceptors will acquire the threat cluster and select the RV, and kinetically destroy it.

(U) The Bottom-up Review recommended that the National Missile Defense (NMD) program focus on technology readiness rather than on deployment. Consequently, the FY93 Ground Based Interceptor (GBI) procurement was cancelled and the GBI project was redirected to develop exoatmospheric kinetic kill vehicle technology. The change in funding from \$238.176M to \$57.2M in FY94 and to \$120M in FY95 reflects the emphasis on KKV technology readiness instead of interceptor development for deployment.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

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PE Title: Ballistic Missile Defense (U)

Project Number: 1217

Budget Activity: 03

Adv Technology Dev (U)

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### C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

#### (U) FY 1993 Accomplishments:

o (\$6.8M) Continued Payload Launch Vehicle (PLV) design effort.

o (\$5.2M) Supported characterization of EKV-relevant projected threats through the Airborne Surveillance Testbed.

o (\$6.9M) Supported Advanced Discriminating Interceptor requirements for USASDC.

o (\$62.4M) Fabricated GBI-X brassboard seekers and processors; developed GBI-X passive discrimination software; conducted GBI-X seeker/processor integration; and initiated GBI-X seeker hardware-in-the-loop testing.

#### (U) FY 1994 Plans:

o (\$11.6M) Maintain PLV and Launch Complex activities and complete the destruct firing unit design qualification.

o (\$31.5M) Complete brassboard seeker cold chamber testing; conduct simulations to verify seeker hardware and algorithm performance against planned flight test scenario; and conduct detailed technical evaluations and down select to two GBI-X kinetic kill vehicle approaches.

o (\$14.1M) Begin integration and preparation for brassboard seeker flight tests to be conducted beginning in FY95.

#### (U) FY 1995 Plans:

o (\$11.9M) Continue government preparation for and conduct of brassboard seeker flights, including Kwajalein Missile Range launch facilities and support activities.

o (\$74.6M) Complete integration of brassboard hardware and software; complete seeker ground tests, performance evaluations, and simulation updates; conduct hardware-in-the-loop simulations to qualify seeker for flight testing.

o (\$33.5M) Continue preparations for and conduct sensor flights with the PLV system.

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PE Title: Ballistic Missile Defense (U)

Project Number: 1217  
Budget Activity: 03  
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(U) Program Plan to Completion: This is a continuing program.

D. (U) WORK PERFORMED BY:

- o Lockheed Missiles and Space Company - Sunnyvale, CA
- o Martin Marietta Corporation - Orlando, FL
- o Hughes Aircraft Company - Canoga Park, CA
- o Rockwell International - Lakewood, CA
- o U.S. Army Program Executive Office (PEO) Missile Defense (Mr. Katechis)
- o U.S. Navy PEO Missile Defense (CDR Hollis)
- o U.S. Air PEO Missile Defense (Col Fitzgerald)

E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

1. TECHNICAL CHANGES:

The program has been reoriented from an acquisition program (2202, Ground Based Interceptor) to a technology readiness program (1217, KKV Technology). No NMD GBI contract will be awarded. Kinetic Kill Vehicle development will be accomplished via the existing GBI-X contracts. Booster development has been deferred. Flight experiments will be conducted using existing launch vehicles as surrogates for a dedicated booster. Flight tests have been reduced in number.

2. SCHEDULE CHANGES:

There will be no acquisition milestones. Flight test preparation begins in FY1994.

3. COST CHANGES:

Program budget has been reduced by \$27.85M in FY1993, \$180.976M in FY1994, and approximately \$2B in the outyears.

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Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1217  
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F. (U) PROGRAM DOCUMENTATION:

- o Technical Requirements Document (TRD) - 8/92
- o Test and Evaluation Master Plan (TEMP) - 6/92
- o Cost, design, test & contractor progress documents

G. (U) RELATED ACTIVITIES:

- o 3300 T&E Resources PE No. 0603217C
  - o 1201 Interceptor Components PE No. 0603217C
  - o 3101 Engineering/Integration Support PE No. 0603217C
  - o 1504 Materials and Structures PE No. 0603217C
  - o 1101 Passive Sensors PE No. 0603217C
- There is no unnecessary duplication of effort within BMDO or the DoD.

H. (U) OTHER APPROPRIATION FUNDS: None.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) MILESTONE SCHEDULE:

- o Conduct Design Review 3QFY94
- o Downselect to two contractors 3QFY94
- o Conduct brassboard seeker flight #1 2QFY95
- o Conduct brassboard seeker flight #2 4QFY95
- o Downselect to one contractor 1QFY96
- o Conduct prototype KKV flight #1 4QFY97
- o Conduct prototype KKV flight #2 3QFY98
- o Conduct prototype KKV flight #3 2QFY99

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C  
 PE Title: Ballistic Missile Defense (U)

Project Number: 1301  
 Budget Activity: 03  
 Adv Technology Dev (U)  
 February 1994

A. (U) RESOURCES: (\$ in Thousands)  
Project Title: Radio Frequency Free Electron Laser (RFFEL)  
 Technology

Program Name: 0603217C RDT&E	FY1993	FY1994	FY1995	FY1996	FY1997	FY1998	FY1999	Total
	Actual	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Program Completed
	14,232	0	0	0	0	0	0	0

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) The goal of the RFFEL program is to demonstrate the capability of a high power FEL to perform boost phase and post-boost phase intercept of ballistic missiles or theater missiles from earth orbiting platforms. Midcourse interactive discrimination is also possible by destroying simple decoys and thermally tagging or imparting velocity change to sophisticated decoys. Additional Space Based (SB) FEL missions include self defense, defense of other platforms in the strategic defense constellation, and the suppression of tactical aircraft. The laser also has dual-use capabilities for research in materials science, advanced ultraviolet photolithography, medical treatments, and other industry applications.

(U) The primary thrust of the current program is the design and fabrication of a proof-of-principle FEL device to validate FEL technology and prove power scaling capability for ballistic and theater missile defense requirements. This effort is called the Average Power Laser Experiment (APLE). The APLE is a tunable (9-11 micron) 100kW average power FEL using a Single Accelerator Master Oscillator-Power Amplifier (SAMOPA) design.

(U) FEL technology development is planned in parallel with the APLE device fabrication, concentrating on advancing and tailoring technology required for FEL operation in space, on a ship, or on a mobile ground-based platform. This technology includes improved system efficiency, and the development of superconducting and cryogenic accelerators. The technology development strategy leverages a large amount

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## FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1301  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

of beam control, optics and acquisition, tracking, pointing, and power technologies from other directed energy weapon projects.

(U) In response to the FY93 Defense Authorization Act, the entire FEL program, including all out year TOA, was transferred to the Army under PE602609A, effective October 1, 1994.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

### C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

#### (U) FY 1993 Accomplishments:

- 0 (\$1,850) Conducted high power oscillator final design review; completed design study for advanced cryogenic FELs.
- 0 (\$4,312) APLE photo-injector qualification test successfully completed.
- 0 (\$4,330) Completed fabrication and assembly of two 3-cell and 5-cell accelerator modules.
- 0 (\$2,620) Fabricated low level RF phase & amplitude controls, electron beam diagnostics, and drive laser.
- 0 (\$1,120) Continued development of medical FEL applications; developed design for automated FEL controls and advanced FEL designs.

#### (U) FY1994 Plans:

#### (U) FY1995 Plans:

(U) Program Plan to Completion: None

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C  
PE Title: Ballistic Missile Defense (U)

Project Number: 1301  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

D. (U) WORK PERFORMED BY:

(U) Major Contractors:

o APLE - Boeing Aerospace and Electronics - Seattle, WA, with technical support from Los Alamos National Laboratory - Los Alamos, NM, and Duke University, Durham, NC.

E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

1. TECHNICAL CHANGES:

2. SCHEDULE CHANGES:

3. COST CHANGES:

F. (U) PROGRAM DOCUMENTATION:

o APLE Preliminary Design Review Report 1Q/FY92  
o Final Report on SABLE (horiz. beam path experiment) 2Q/FY92  
o APLE High Power Oscillator Final Design Review Report 1Q/FY93  
o APLE Amplifier Preliminary Design Review Report TBD

G. (U) RELATED ACTIVITIES:

o 1302 Chemical Laser PE No. 0603217C  
o 1305 Acquisition, Tracking & Pointing/Fire Control PE No. 0603217C  
o 1503 Power & Power Conditioning PE No. 0603217C  
(U) There is no unnecessary duplication of effort within BMD0 or the DoD.

H. (U) OTHER APPROPRIATION FUNDS: None

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1301  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

- I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Cooperative research agreement with the Ministry of Defense of the Republic of France.
- J. (U) MILESTONE SCHEDULE:
- |   |   |         |
|---|---|---------|
| o | APLE Photoinjector completed                          | 4Q/FY92 |
| o | Los Alamos APLE Prototype Experiment completed        | 1Q/FY93 |
| o | APLE Accelerator Test at full klystron power complete | 4Q/FY93 |
| o | APLE Electron Beam Accelerator Test complete          | TBD     |
| o | High Power Oscillator Laser Test                      | TBD     |

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C  
PE Title: Ballistic Missile Defense (U)

Project Number: 1302  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

A. (U) RESOURCES: (\$ in Thousands)  
Project Title: Chemical Laser Technology

Program Name: 0603217C RDT&E	FY1993 Actual	FY1994 Estimate	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999	
							Estimate	Total Program Continuing
	69,164	54,269	77,500	77,500	77,500	77,500	77,500	

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

The Chemical Laser (CL) program is developing high leverage high energy laser (HEL) technologies for future ballistic missile defense against an evolving, proliferating threat. The program is composed of a ground integration/demonstration of HEL components developed by BMDO over the past decade as well as the development of advanced HEL technologies. Since the formation of BMDO, the CL program has served as a national focal point for the development of HEL technologies, currently serving as a springboard for emerging Service programs for air- (USAF), ground- (USA), and sea- (USN) based HEL programs. However, the highest leverage basing of this technology, under development since the formation of BMDO, is the space-based laser.

(U) The space-based laser (SBL) is the only major U.S. technology under development that can provide global, 24-hour, early-boost-phase intercept (BPI) of both theater and strategic ballistic missiles: Early BPI negates ballistic missiles before they can multiply into tens or hundreds of targets through the early release of chemical, biological, or nuclear munitions. Early BPI also serves as a powerful deterrent, as debris falls far from defended territory, often back on the attackers. Finally, boost phase intercept will allow affordable defenses as the range of available ballistic missiles increases, allowing the defense to concentrate on the aggressor, rather than trying to defend all of the potential targets within his range with terminal defensive systems.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1302  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

(U) Critical technical issues for the SBL element can be grouped into five areas: the laser device; beam control; optics; acquisition, tracking, pointing and fire control (ATP/FC); and high power integration. The laser or beam generating device is a hydrogen fluoride (HF) chemical laser which produces the high power laser beam by photon extraction from excited HF molecules, generated by the energetic reaction of hydrogen and fluorine. In multiple tests from 1990 through 1993, the Alpha HF laser demonstrated near-weapon-level continuous-wave operation. The Alpha design is space compatible and directly scalable to weapon-level power requirements. Required beam control technology was demonstrated by the LODE program in 1987. Required optical technology can be subdivided into two classes: small high-intensity optics for handling the high power beam within the SBL and large moderate-incident-intensity optics for directing the expanded high power beam toward the target. Required small high-intensity optics have been demonstrated in a number of SBL programs, including Alpha. The LAMP program, completed in 1989, demonstrated a 4-meter diameter beam director primary mirror whose design is space-compatible and directly scalable to weapon size. ATP/FC technology is being developed in Project 1305 and has made excellent progress toward developing the technology to meet SBL ATP/FC requirements. High power integration is being demonstrated in the Alpha & LAMP Integration (ALI) program. In ALI, the Alpha, LODE, and LAMP hardware and technologies are being integrated for ground demonstration of an SBL high power beam train in FY96. In parallel, a number of efforts are developing additional promising technologies with the potential for significant cost, weight, and/or brightness improvement. These efforts include continued development of very-low-absorbance optical coatings and mirror substrates which allow high power optics to be uncooled (ultralightweight), shorter wavelength lasers that may achieve equivalent range performance with a smaller diameter beam director mirror (HF overtone), molecular (rather than mechanical) methods for compensation of beam aberrations to produce the required beam quality (Stimulated Brillouin Scattering (SBS) phase conjugation), and manufacturing techniques for improving the producibility and decreasing the cost of large optics (Large Optical Segment (LOS) Program).

(U) After the completion of ALI, the ALI hardware and designs will be repackaged into an operational configuration. A conceptual design and program plan for this demonstration, named Star LIIE, has already

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1302  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

been developed. In Star LITE, ALI hardware and designs are repackaged, mated with an ATP suite, and ground tested. Upon completion, an option can be executed to mate Star LITE with a launch vehicle for a space demonstration of the weapon-scalable Star LITE SBL against simulated ballistic missiles targets. Completion of the Star LITE experiment will demonstrate the readiness of the SBL for a decision on the development of a full scale prototype. With additional Chemical Laser funding, an initial operational capability for the SBL could be achieved by the middle of the next decade.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1993 Accomplishments:

0	(\$37.771M) Continued fabrication and delivery of ALI experiment hardware and facility
0	(\$10.570M) Demonstrated high power performance of an uncooled optic in the Alpha resonator; demonstrated enhanced Alpha performance
0	(\$5.160M) Completed fabrication of SBS non-linear optics demonstration cell (Oct 93)
0	(\$3.009M) Began fabrication of first full-scale advanced HF-overtone laser nozzle module
0	(\$2.450M) Completed fabrication of first LOS 4-meter mirror facesheet (outer petal facesheet of space compatible 11 meter diameter mirror)
0	(\$4.200M) Demonstrated the fabrication of subscale uncooled annular mirror for uncooled resonator
0	(\$4.018M) Completed/continued numerous small advanced technology research/demonstration efforts including alternate HF chemical laser fuels and ignition technologies, SBL simulation and performance analyses, and transfer of SBL optical technology to astronomical community
0	(\$1.800M) Completed preliminary design for autonomous beam control system alignment demonstration
0	(\$0.186M) Completed study of Army tactical uses of chemical laser technologies

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## FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1302

Budget Activity: 03

Adv Technology Dev (U)

February 1994

### (U) FY 1994 Plans:

- o (\$31.119M) Continue fabrication and delivery of ALI experiment hardware; bring ALI facility to beneficial occupancy status
- o (\$10.250M) Modify Alpha for interface with ALI; demonstrate high power operation of modified Alpha
- o (\$2.600M) Perform fluid dynamic testing of the SBS cell
- o (\$2.000M) Complete fabrication and testing of first advanced HF-overtone laser nozzle module
- o (\$3.550M) Complete/continue numerous small advanced technology research/demonstration efforts including beam expander repointing/stabilization technology, small scale autonomous alignment risk reduction, HF laser master oscillator/power amplifier (MOPA) measurements, HF laser line-selection measurements, and application of neural net technology to precise pointing and disturbance rejection
- o (\$1.600M) Complete fabrication of second LOS 4-meter mirror facesheet (center petal facesheet of space compatible 11 meter diameter mirror)
- o (\$2.740M) Continue development of advanced optical coatings for uncooled optics; Demonstrate all fabrication technologies for full scale annular resonator optic substrate (including diamond turning across fused single crystal silicon bond joints)
- o (\$0.410M) Begin modification of the Advanced Beam Control System brassboard for autonomous beam control system alignment demonstration

### (U) FY 1995 Plans:

- o (\$43.730M) Integrate ALI hardware and begin subsystem testing
- o (\$10.750M) Develop the technology and demonstrate autonomous alignment of the Alpha resonator; complete final modifications of Alpha for ALI
- o (\$4.700M) Design, fabricate and install optics for the SBS demonstration
- o (\$4.100M) Begin fabrication of remaining HF-overtone laser nozzle modules
- o (\$1.700M) Restart preliminary design for ground Star LITE demonstration; establish test facility requirements
- o (\$3.700M) Begin fabrication of full scale uncooled resonator for Alpha/Star LITE

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1302  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

- o (\$2.100M) Begin design and fabrication of 4 meter monolithic primary mirror for Star LITE
- o (\$2.000M) Complete modification of the Advanced Beam Control System brassboard for autonomous beam control system alignment demonstration
- o (\$4.720M) Complete/continue numerous small advanced technology research/demonstration efforts

(U) Program Plan to Completion: This is a continuing program.

D. (U) WORK PERFORMED BY:

- o Hughes Danbury Optical Systems - Danbury CT
- o Litton-Itek - Lexington, MA
- o Martin Marietta - Denver, CO
- o Lockheed Missiles & Space Corp. - Sunnyvale, CA
- o TRW - Redondo Beach, CA

E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY

1. TECHNICAL CHANGES: None.
2. SCHEDULE CHANGES: None.
3. COST CHANGES: Funding reductions from prior plans continue to produce schedule slippage in all chemical laser efforts.

F. (U) PROGRAM DOCUMENTATION:

- o Numerous technical reports documenting scientific analyses, hardware designs, and experimental results and assessments.

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## FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1302  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

### G. (U) RELATED ACTIVITIES:

- o 1301 Free Electron Laser PE No. 0603217C
  - o 1305 Target Acquisition, Tracking and Pointing PE No. 0603217C
  - o 1307 Advanced Directed Energy Demonstrations PE No. 0603217C
- There is no unnecessary duplication of effort within BMDO or the DoD.

### H. (U) OTHER APPROPRIATION FUNDS: None

### I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

### J. (U) MILESTONE SCHEDULE:

- o ALI Facility Beneficial Occupancy 4Q FY 94
- o Complete fabrication of second 4-meter LOS facesheet for an 11-meter mirror 4Q FY 94
- o Integrate ALI hardware and begin subsystem testing 4Q FY 95
- o ALI High Power Demonstration 3Q FY 96
- o Continuous wave SBS Demonstration 4Q FY 96
- o Autonomous Beam Train Alignment Demonstration 4Q FY 96
- o High Power HF-Overtone Demonstration 2Q FY 97

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1303  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

A. (U) RESOURCES: (\$ in Thousands)

Project Title: Neutral Particle Beam Technology

	FY1993	FY1994	FY1995	FY1996	FY1997	FY1998	FY1999	Total
<u>Program Name:</u>	<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Program</u>
0603217C RDT&E	39,126	7,392	0	0	0	0	0	Completed

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) The Neutral Particle Beam (NPB) project exploits the capability of a stream of atomic particles to penetrate into a target (1) to provide lethal energies and/or (2) to induce signatures that permit discrimination. Such a beam is capable of effecting kill of ballistic missiles in the boost, post-boost, and midcourse phases.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1993 Accomplishments:

- o (\$21.440M) Assemble GTA 24-MeV accelerator; complete advanced optics design.
- o (\$7.950M) Demonstrate initial operation of high duty factor RFQ on CWDD.
- o (\$5.260M) Continue NPBSE design; conduct visits in Russia and US for planning a joint NPBSE.
- o (\$4.476M) Conduct CDR on solid state RF amplifier design; continue NPB component technologies development.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1303  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

- (U) FY1994 Plans:  
o (\$7.392M) Termination. Most programs have already been terminated. Others are in abeyance until final plans for termination can be formulated.
- (U) FY1995 Plans: None
- (U) Program Plan to Completion: None
- D. (U) WORK PERFORMED BY:
- (U) Major Contractors:  
o Argonne National Laboratory - Chicago, IL  
o Culham Laboratory (UK)  
o Grumman - Bethpage, NY  
o Hanford Engineering Development Laboratory - Hanford, WA  
o Lawrence-Berkeley Laboratory - Berkeley, CA  
o Los Alamos National Laboratory - Los Alamos, NM  
o McDonnell Douglas - St. Louis, MO & Huntington Beach, CA
- E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:
1. TECHNICAL CHANGES:  
2. SCHEDULE CHANGES:  
3. COST CHANGES: Due to a large decrease in support for Directed Energy (DE) research and development, some programs of this effort have already been terminated, the remaining programs currently are put into abeyance until final plans for termination can be formulated.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C  
PE Title: Ballistic Missile Defense (U)

Project Number: 1303  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

F. (U) PROGRAM DOCUMENTATION:

- o NPB Program Plan, CWDD, GTA, NPB Space Experiment Program Reviews, Concept Definition documents.
- o HEL Design and Concept reports

G. (U) RELATED ACTIVITIES:

- o 1305 Acquisition, Tracking, and Pointing PE No. 0603217C
- o 2204 DEW Concept Definition PE No. 0603217C

(U) Activities in this program element are closely coordinated with activities in the other BMDO program elements. There is no unnecessary duplication of effort within BMDO or the DoD.

H. (U) OTHER APPROPRIATION FUNDS: None

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: SCORE Agreement with UK.

J. (U) MILESTONE SCHEDULE:

- o CWDD RFQ Operational 4Q/FY93

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1305  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

A. (U) RESOURCES:  
(U) Project Title:

(\$ in Thousands)  
Acquisition, Tracking, Pointing and  
Fire Control Technology

	FY1993 Actual	FY1994 Estimate	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	Total Program Continuing
Program Name: 0603217C RDT&E	21,067	6,492	12,500	12,500	12,500	12,500	12,500	

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) Acquisition, tracking, pointing and fire control (ATP/FC) efforts will advance the technologies required to perform critical functions for candidate Directed Energy Weapons (DEW) concepts to be deployed after the initial deployment of TMD and NMD architectures. These functions include acquiring, identifying, and prioritizing the targets to be engaged, precision tracking of each target, selecting and establishing the line-of-sight to the target aimpoint, holding the beam on the aimpoint, assessing the results, and reinitiating the sequence to engage a new target. Most of these functions also address problems common to the kinetic energy theater missile defense systems being developed by BMD. ATP/FC technologies are required for both boost-phase destruction and midcourse interactive discrimination missions.

(U) Efforts within the ATP/FC technology base address major tracking/pointing component performance issues, and development of technologies for advanced ATP/FC integrated experiments. Among these are the Advanced DEW Active Precision Tracker (ADAPT) program to design an advanced ATP system for a comprehensive space demonstration. A series of field experiments with payloads on high altitude balloon experiment (HABE) platforms will obtain critically needed phenomenology data and build upon technology base products to demonstrate all the tracking and functional integration needed to control single target engagements. ATP/FC simulation tools and algorithms are being developed for directed energy weapons, with current emphasis to support HABE testing. In addition, the space integrated controls experiment

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1305  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

(SPICE) assesses the ability and means of incorporating passive and active vibration damping systems in the design of structures requiring high precision pointing accuracy.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1993 Accomplishments:

- o (\$600.0M) Completed LACE spacecraft operations using LACE targets; issued a final report.
- o (\$2.500M) Conducted first field tests with high altitude balloons. KESTREL system was successfully launched at sea and recovered. Program was terminated after first field test due to funding cuts.
- o (\$9.660M) Conducted first field tests of the land launched high altitude balloon experiment (HABE). Development of HABE payload continued but HABE flights have been suspended pending redesign of balloon system.
- o (\$2.650M) Completed fabrication, assembly and test of first 2 AXIS Inertial Pseudo-Star Reference Unit (IPSRU). Started modifications for 3 AXIS flight qualifiable IPSRU.
- o (\$950.0M) Completed a closed loop demonstration of active control of structural disturbances on the SPICE test bed. Achieved jitter rejection ratio of 65:1, surpassing the previous state-of-the-art ratio of 10:1. Developed technologies to rapidly reposition and retarget structures such as those required for a space-based directed energy weapon.
- o (\$1.075M) Conducted ADAPT Operational Requirements Review for an advanced concept ATP system for directed energy space systems. Completed ADAPT special study and lab experiments on High Power Shared Aperture Optics.

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## FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1305

Budget Activity: 03

Adv Technology Dev (U)

February 1994

- 0 (\$1.762M) Conducted computer modeling of generic ATP-FC systems for directed energy weapon systems concepts. Integrated development payload and data information system for the HABE program.
- 0 (\$500.0M) Completed component fabrication of laser illuminator for HABE flight experiments.
- 0 (\$1.100M) Completed aimpoint selection algorithm development and initiated Hard-Body-Handover algorithm for HABE experiments.
- 0 (\$270.0M) Completed environmental assessments for the HABE programs.

### (U) FY 1994 Plans:

- 0 (\$2.200M) Continue HABE ATP system integration and conduct ground experiments against scaled rockets. Accept delivery of IPSRU and flight illuminator laser for system integration.
- 0 (\$1.400M) Integrate advanced ATP-FC technologies into test and evaluation experiments. Develop simulation and data archival tools for ATP-FC components and test experiments.
- 0 (\$0.950M) Test and deliver first 3 axis IPSRU unit to HABE ATP experiments program.
- 0 (\$0.942M) Finalize advanced ATP technology reference concepts and develop experiment and test concepts to validate advanced system design.
- 0 (\$0.500M) Finalize structural disturbance damping tests, evaluate system identification algorithms, and document system configuration.
- 0 (\$0.500M) Complete Hard-Body-Over algorithm development and deliver to HABE.

### (U) FY 1995 Plans:

- 0 (\$1.700M) Continue ATP/FC integration efforts and perform preliminary analysis on concepts for future precision ATP/FC systems for the spaced-based laser system concept.
- 0 (\$7.300M) Conduct balloon system checkout flight for HABE and plan/conduct ATP ground integrated system checkout against scaled rockets.
- 0 (\$1.000M) Develop the aimpoint selection and target identification algorithms. Upgrade the attack management development facility to provide end-to-end ATP-FC simulation capability.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C  
PE Title: Ballistic Missile Defense (U)

Project Number: 1305  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

- o (\$1.700M) Identify critical technology issues and development paths to resolve those issues. Analyze impact of technology developments and test data obtained and analyzed from scaled tests and simulations on ATP-FC architectures. Develop information distribution system for the HABE program.
- o (\$0.800M) Restart laser illuminator project to develop an advanced operational level illuminator laser, and procure critical spares for the HABE IPSRU unit.

(U) Program Plan to Completion: This is a continuing program.

D. (U) WORK PERFORMED BY:

(U) Government:

- o Phillips Laboratory, Kirtland AFB, NM
- o Lawrence Livermore National Laboratory, Livermore, CA
- o U.S. Army Space and Strategic Defense Command, Huntsville, AL
- o Rome Laboratory, Griffiss AFB, NY

(U) Major Contractors:

- o LMSC - Sunnyvale, CA and Albuquerque, NM
- o Martin Marietta - Denver, CO
- o GRC - McLean, VA
- o TASC - Santa Ana, CA and Reading, MA
- o Logicon/RDA - Albuquerque, NM
- o CS Draper Laboratory, Cambridge, MA

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1305  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

1. TECHNICAL CHANGES:

(U) As a result of HABE balloon design problems encountered in June of 1993, implementation of balloon changes are underway, which will allow the flight program to continue and achieve its stated objectives.

2. SCHEDULE CHANGES:

(U) Other than budget driven schedule slips, the only schedule slippage is with HABE, due to balloon redesign. Approximately three months delay in the balloon system checkout would have occurred if budget constraints had not been encountered.

3. COST CHANGES:

(U) The FY93/94 funding drop will temporarily stop HABE flight activities, slows down algorithm development activities, and precludes the acquisition of a planned 2nd IPSRU unit. Scaled down HABE flight activities will restart in FY95, with the program stretched out. Reductions from the April 93 BES (FY95-99) result in dramatically reduced efforts for ATP/FC systems.

F. (U) PROGRAM DOCUMENTATION:

o Numerous periodic and technical reports documenting reviews, scientific analysis, hardware designs, and experimental results and assessments.

G. (U) RELATED ACTIVITIES:

o	1302 Chemical Laser	PE No 0603217C
o	1307 Advanced Directed Energy Demo	PE No 0603217C
o	1209 Endo Technology	PE No 0603217C

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1305  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

There is no unnecessary duplication of effort within BMDO or DoD.

H. (U) OTHER APPROPRIATION FUNDS: None

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

J. (U) MILESTONE SCHEDULE:

o	Complete testing of Solid State Laser illuminator brassboards	1Q/FY94
o	Complete Low Authority Control (LAC) SPICE test/issue report	3Q/FY94
o	Integrate hardbody handover (HBHO) algorithms into Advanced ATP designs and concepts	4Q/FY94
o	Complete fabrication/testing of 1st 3 AXIS IPSRU	2Q/FY94
o	Restart High Altitude Balloon Experiments (HABE)	1Q/FY95
o	Complete first HABE Checkout flight	3Q/FY95

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1307  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

A. (U) RESOURCES: (\$ in Thousands)  
Project Title: DE Demonstrations

Program Name: 0603217C RDT&E	FY1993 Actual	FY1994	FY1995	FY1996	FY1997	FY1998	FY1999	Total
		Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Program Continuing
	21,038	1,991	0	0	0	0	0	0

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) The Aircraft Based Laser (ABL) is a Directed Energy Weapon (DEW) concept for theater missile defense. The speed of light capability of the laser weapon may allow the ABL to destroy theater missiles during boost phase at long range, providing a boost phase defense layer that does not require overflight of enemy territory. Destroying theater missiles during boost phase provides many advantages. The missile is most vulnerable during this phase of flight. It is easy to detect and track the plume from the firing rocket engine. The defense system only has to deal with a single target during boost phase since it is not practical to deploy decoys or submunitions during this phase of flight. Experiments and analysis leading to an understanding of the operational effectiveness of this concept are performed.

(U) A second effort within this program is studying the feasibility of scaling the Diode-Pumped Solid-State Laser (DPSSL) to levels adequate for airborne weapon applications. Russian technology is being evaluated to assess the possibility of a joint program to exploit their past investments in directed energy weaponry.

(U) A third effort is a series of radially-inbound missile defense tests using the Mid-Infrared Advance Chemical Laser (MIRACL) and Sealite Beam Director (SLBD) at the White Sands Missile Range (WSMR), White Sands, NM. This is a jointly funded BMDO/US Navy/United Kingdom Royal Navy effort.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1307  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1993 Accomplishments:

- ABL:
- 0 (\$4386) Continue atmospheric measurements from aircraft and balloons begun in FY 1992.
  - 0 (\$6528) Continue mission analysis, performance analysis, and engineering trade studies for theater DEW concepts.
  - 0 (\$5994) Initiate Airborne Atmospheric Compensation and Tracking (AACT) program.

DPSSL:

- 0 (\$800) Design compact laser diode pumping array.
- 0 (\$1000) Conduct risk reduction cooling experiments with diode pumping arrays.
- 0 (\$600) Design and calculate mist cooling model for glass laser disks.
- 0 (\$400) Conduct planning for joint solid-state laser development effort with Russia.
- 0 (\$330) Conduct weapon concept studies for DPSSLs.
- 0 (\$380) Continue Boost Phase Interception (BPI) studies incorporating DPSSL weapon option.
- 0 (\$320) Support enabling technologies for diode packaging and crystal growth.

MD Test:

- 0 (\$250) Initiate static lethality tests on selected missiles at WSMR (BMDO contribution).
- 0 (\$50) Conduct safety assessments and develop test plans for selected missile targets at WSMR (BMDO contribution).

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1307  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

(U) FY 1994 Plans:

(U) FY 1994 ABL Plans:

o (\$250) Program has been transferred to the Air Force; per agreement, BMDO provides oversight.

(U) FY 1994 DPSSL Plans:

o (\$1691) None, program is in termination.

(U) FY 1994 MD TESTS Plans:

o (\$40) BMDO share for static and dynamic radially in-bound missile defense tests.  
o (\$10) BMDO share to analyze data and prepare test report.

(U) FY 1995 Plans:

o None

(U) FY 1996 Plans:

o None

(U) Program Plans to Completion:

o None

(U) WORK PERFORMED BY:

o ABL: U.S. Air Force Phillips Laboratory, Albuquerque, NM.  
o DPSSL: Lawrence Livermore National Laboratory, Livermore, CA.  
o MD Test: U.S. Army White Sands Missile Range, NM

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C  
PE Title: Ballistic Missile Defense (U)

Project Number: 1307  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

1. TECHNICAL CHANGES:

o None for any of the programs at this time.

2. SCHEDULE CHANGES:

o None for any of the programs at this time.

3. ABL COST CHANGES:

o Due to a large decrease in support for Directed Energy (DE) research and development, BMDO's oversight role has decreased to a very small effort.

DPSSL COST CHANGES:

o Due to a large decrease in support for Directed Energy (DE) research and development, this effort will not be continued by BMDO.

MD TEST COST CHANGES: None.

F. (U) PROGRAM DOCUMENTATION:

(U) ABL Program Documentation:

o Monthly Letter reports  
o Final report

(U) DPSSL Program Documentation:

o Quarterly on-site progress reviews  
o Final Progress Summary report.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1307  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

(U) 0 MD TEST Program Documentation:  
Final Test report

G. (U) RELATED ACTIVITIES:

0	1301 Free Electron Laser	PE No. 0603217C
0	1302 Chemical Laser	PE No. 0603217C
0	1303 Neutral Particle Beam	PE No. 0603217C
0	1305 ATP/FC	PE No. 0603217C
0	1307 DE Demo	PE No. 0603217C
0	1504 Materials and Structures	PE No. 0603217C
0	3201 Architecture Studies	PE No. 0603218C

There is no unnecessary duplication of effort within BMDO or the DoD.

H. (U) OTHER APPROPRIATION FUNDS: None

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

J. (U) MILESTONE SCHEDULE:

(U) 0 MD Test Milestones:  
0 Static Tests  
0 Dynamic Tests

12-31-1993  
09-30-1994

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1403  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

A. (U) RESOURCES: (\$ in Thousands)  
Project Title: Computer Engineering Tech

	FY1993	FY1994	FY1995	FY1996	FY1997	FY1998	FY1999	Total
<u>Program Name:</u>	<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Program</u>
0603217C RDT&E	2,630	0	2,500	0	0	0	0	Completed

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) This effort provides support and technologies required for advanced Command, Control and Communication (C3) concepts through short term demonstrations and integration with other sensor and interceptor technology programs. There are several projects supported by this PMA. The first supports the development of missile tracking software for PAVE PAWS and BMEWS early warning radars. Radar track correlation and cueing techniques will be matured. Other sensors, such as the Miniature Sensor Technology Integration (MSTI) satellite, or prototype command nodes may be included with operational sensors. Satellite based inflight target updates will be investigated and demonstrated with experimental interceptor testbeds. This may allow very large areas to be defended by theater weapons.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1993 Accomplishments:  
o (\$630K) Demonstrated fault tolerant multiprocessor architecture.  
o (\$1.0M) Created new missile tracking software for PAVE PAWS radar.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1403  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

- o (\$100K) Created sensor fusion software.
- o (\$900K) Conducted PAVE PAWS Early warning Tracking experiment.
- (U) FY 1994 Plans:
  - o (\$0) Develop missile tracking software for BMEWS pending funds.
  - o (\$0) Conduct BMEWS early warning tracking experiment pending funds.
  - o (\$0) Conduct radar-optical correlation experiment pending funds.
  - o (\$0) Begin satellite in-flight update development pending funds.

- (U) FY 1995 Plans:
  - o (\$250K) Conduct BMEWS - PAVE PAWS hand off experiment
  - o (\$1.25M) Conduct in-flight update experiment
  - o (\$1.0M) Develop missile tracking software for BMEWS.

(U) Program Plan to Completion: This is a continuing program.

D. (U) WORK PERFORMED BY:

- o Raytheon, Wayland, MA
- o Xontech Inc., Van Nuys, CA
- o Phillips Laboratory - Kirtland AFB, NM
- o Lawrence Livermore National Lab - Livermore, CA

E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

1. TECHNICAL CHANGES: New BMC3 demonstrations are planned based upon FY93 successes.
2. SCHEDULE CHANGES: Major demonstrations postponed until FY95 to conserve current funds. New FY95 demonstrations support evolving Technology Readiness Program.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1403  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

3. COST CHANGES: Additional (\$2.5M) funds secured for FY95 experiments.

F. (U) PROGRAM DOCUMENTATION: Final Monthly Technical Status Reports.

G. (U) RELATED ACTIVITIES: This program supports and is coordinated with developing sensor and interceptor technologies, as well as systems BMC3 concepts.

H. (U) OTHER APPROPRIATION FUNDS: None

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

J. (U) MILESTONE SCHEDULE:

0	MSTI-PAVE PAWS integration demonstration	2Q/FY94
0	BMEWS software development	3Q/FY94
0	BMEWS demonstration	4Q/FY94
0	In-Flight Update demonstration	1Q/FY95
0	BMEWS/PAVE PAWS demonstration	2Q/FY95
0	BMEWS/PAVE PAWS demonstration	2Q/FY95

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# U N C L A S S I F I E D

## FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1405  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

A. (U) RESOURCES: (\$ in Thousands)  
Project Title: Communications Engineering Tech

Program Name:	FY1993 Actual	FY1994 Estimate	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	Total Program Completed
0603217C RDT&E	12,205	1,932	500	0	0	0	0	

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENTS AND SYSTEM CAPABILITIES:

(U) Develop communications technology to support operational requirements for defensive systems. Develop communications components, both radio frequency (RF) and laser communications, for space-to-space, space-to-ground, and ground-to-space links. Efforts to define requirements for space qualification and radiation hardness of extremely high frequency (EHF) components needed for robust communications are included.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U)	FY 1993 Accomplishments:
0	(\$741K) Delivered 3-Watt, 60 Ghz Solid State Power Amplifier.
0	(\$1.0M) Delivered integrated EHF transceiver brassboard.
0	(\$1.935) Integrate radiation hardened 60 Ghz transceiver and test for radiation survivability.
0	(\$200K) Demonstrated 1 watt power and 1 Ghz modulation of MAG-MOPA laser diode.
0	(\$201K) Delivered radiation hardened CCD design rules and Acousto-Optic beam steerer.

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## FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1405  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

- 0 (\$200K) Completed advanced adaptive networking development.
- 0 (\$600K) Completed seeker data compression breadboard.
- 0 (\$700K) Completed design of miniature high data rate telemetry system for KKV testing.
- 0 (\$1.174M) Initiated design of 60 Ghz communications flight test package.
- 0 (\$589K) Increase power output from broad area MOPA laser diode.
- 0 (\$0.035M) Completed 60 Ghz Phased Array Test at Rome Laboratory.
- 0 (\$0.05M) Continued 60 Ghz InP Technology Study.
- 0 (\$0.35M) Initiated 60 Ghz Agile Aperture Program.
- 0 (\$700K) Initiated 20/44 Ghz GEP antenna design.
- 0 (\$170K) Initiated software design to support 20/44 Ghz GEP antenna design.
- 0 (\$1.55M) Completed programmable digital modem preliminary development module design.
- 0 (\$1.157M) Continued Rome Laboratory direct support of contracts.
- 0 (\$183K) Continued system modelling.
- 0 (\$309K) Completed Code Division Multiple Access (CDMA) Receiver.
- 0 (\$300K) Completed 8x8 APD Array.
- 0 (\$100K) Completed Liquid Crystal Device Prototypes.
- 0 (\$44K) Completed Acousto-optic Beam Steerer.

### (U) FY 1994 Plans:

- 0 (\$450K) Complete second integrated 20/44/60 Ghz transceiver breadboard.
- 0 (\$40K) Complete and deliver miniaturized telemetry breadboard for high data rate seeker applications.
- 0 (\$218K) Deliver programmable digital modem preliminary development module.
- 0 (\$0K) Complete life testing of 60 Ghz MMIC power amplifiers.
- 0 (\$724K) Complete and deliver miniature high data rate telemetry system for KKV testing.
- 0 (\$100K) Continue radiation testing of radiation hardened 60 Ghz transceiver.
- 0 (\$400K) Continue Rome Laboratory Direct support of contracts.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1405  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

- (U) 0 FY 1995 Plans:  
(\$500K) Termination Costs.
- (U) Program Plan to Completion: FY95 funding will be applied to termination costs.

D. (U) WORK PERFORMED BY:

- 0 USAF Rome Laboratories - Griffiss AFB, NY and Hanscom AFB, MA  
0 Sandia National Laboratories - Albuquerque, NM  
0 Harris Corporation - Melbourne, FL  
0 TRW - Redondo Beach, CA

E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

1. TECHNICAL CHANGES: Due to budget constraints no reports or hardware for:  
0 20/44 GHz ground based phased array antenna ADMs.  
0 Composite high speed, high power, long lifetime MAG-MOPA laser diode.  
0 60 GHz agile aperture/advanced solid state power amplifier  
0 60 GHz crosslink flight test.  
0 Programmable Flexible Modem Advanced Development Module.  
0 No miniaturized telemetry testing.  
0 No Data Compression Flight Test.  
2. SCHEDULE CHANGES:  
3. COST CHANGES:

F. (U) PROGRAM DOCUMENTATION:

- 0 Final technical reports and test plans.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1405  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

- o Component evaluation reports.

G. (U) RELATED ACTIVITIES: This project supports all BMD projects requiring advanced communications component technologies for space communications. There is no unnecessary duplication of effort within BMDO or the DoD.

H. (U) OTHER APPROPRIATION FUNDS: None

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

J. (U) MILESTONE SCHEDULE:

- o Data Compression Brassboard
  - o MMIC EHF Transceiver Brassboard #2
  - o Complete 60 Ghz MMIC power amplifier tests
  - o Programmable Flexible MODEM PDM Demo
  - o Subminiature Telemetry Prototype
- 2Q/FY94  
3Q/FY94  
3Q/FY94  
2Q/FY94  
3Q/FY94

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C/0603217C

PE Title: Theater Missile Defense / Ballistic Missile Defense (U)

Project Number: 1501  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

A. (U) RESOURCES: (\$ in Thousands)  
Project Title: Survivability

Program Name:	FY1993 Actual	FY1994 Estimate	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	Total Program
0603216C RDT&E	3,120	3,024	4,900	3,800	3,800	3,800	3,700	Continuing
0603217C RDT&E	25,367	3,321	3,000	3,000	4,000	2,000	3,000	Continuing

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) Develops and demonstrates survivability technologies to ensure that Ballistic Missile Defense (BMD) elements can perform their mission in all expected environments and the face of all expected hostile threats. Approaches include: studies/analyses; defense suppression threat mitigation technologies development; Survivability Enhancement Option (SEO) development; Electronic Data/Guidelines for Element Survivability (EDGES) development, Electromagnetic Environmental Effects (E3) engineering support, survivability/operability demonstrations, development of issue resolution approaches, development of Anti-Radiation Missile (ARM) Countermeasure Evaluator (ACE), and hardened technology integration. Technologies will be available for incorporation into BMD elements at EMD and will also provide near-term improvements to existing systems. Demonstrations will provide necessary risk reduction evidence to support milestone decisions.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C/0603217C

PE Title: Theater Missile Defense / Ballistic Missile Defense (U)

Project Number: 1501  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

C. PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1993 Accomplishments:

- o Completed EDGES Version 1.0 for interceptor contractors.
- o Identified candidate RF-hardening technology for NMD sensors and communications
- o Demonstrated no-upset computer technology for interceptors.
- o Developed and demonstrated High Altitude Electromagnetic Pulse (HEMP) hardening technology for the GBR transmit/receive modules.
- o Identified and tested RF/HPM sensor Proof-of-Principle SEOs.
- o Demonstrated 3 wavelength rejection of infrared rugate filters
- o Demonstrated preliminary nonlinear optical response of electro-optic devices for agile wavelength lasers
- o Completed stray light analysis of innovative, survivable reflective baffle
- o Initiated survivability experiment to be demonstrated on the MSTI program
- o Developed initial Unified Electromagnetic Effects (UEME) guidelines for fixed facilities, joint project with DNA
- o Conducted Successful Synthetic Aperture (SAR) radar low probability of detection and identification test employing general purpose CCD material
- o Completed THAAD and GBR vulnerability analyses to ORD and TRD defined threats
- o Performed ARM discrimination and classification analysis for GBR
- o Designed and constructed two prototype radar and millimeter wave omni-directional corner reflector decoys
- o Conducted SEO tactical-technical trade studies for CCD vs hardening tradeoffs and ARM CM SEOs
- o Completed ARM countermeasure evaluator (ACE) test bed design
- o Completed 80% of development of ACE for NMD applications
- o Initiated integrated CCD and armor applique design for ground equipment and vehicles
- o Conducted joint Camouflage, Concealment, and Deception (CD) joint Proof-of-Principle (POP) demonstration

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## FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C/0603217C

PE Title: Theater Missile Defense / Ballistic Missile Defense (U)

Project Number: 1501  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

- o Initiated actions to acquire ARM test articles
- o Identified initial synthetic aperture radar (SAR) countermeasures SEOs
- o Completed draft electromagnetic environmental effects (E3) criteria for TMD-GBR, THAAD, ERINT, GBI
- o Demonstrated RV length bulk filter for risk mitigation in non-homogeneous atmospheric regions
- o Developed radar environment status assessment algorithm (RESA) and initiated integration into STARTACS
- o Developed and tested OPINE track algorithm with dynamic waveform allocation and dispersion
- o First time demonstration of VIS/UV adjunct sensor operating in a nuclear disturbed optical background
- o Evaluated firing strategies for interceptor engagement planner
- o Prototyped command control decision aid for dynamic display of disturbed regions vs interceptor RF link paths
- o Provided survivability technology support (multithreat response modeling, risk mitigation studies, survivability assessment planning) for the Brilliant Eyes (BE) SPO
- o Performed tests and analyses of prompt and delayed nuclear environment effects on critical sensor components including hardened optical coatings, lightweight mirrors, UV/Vis detectors and seeker telescopes
- o Continued development and radiation testing of a hardened 60 GHz RF communication cross-link transceiver
- o Demonstrated prompt and Total Dose hardness of a light-weight ring laser gyro assembly; initiated data analysis of Hunters Trophy SPO materials experiment; provided preliminary evaluation of nuclear hardness of selected solar array concepts
- o Evaluated candidate BE contractor sensor designs for possible RF susceptibilities
- o Completed Vol I of the "Electromagnetic Environmental Effects (E3) Hardening Guidelines for Space Systems"
- o Developed equipment and test apparatus to evaluate RF susceptibility of advanced detectors and focal plane array for space based sensors

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C/0603217C

PE Title: Theater Missile Defense / Ballistic Missile Defense (U)

Project Number: 1501  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

- o Performed review and evaluation of models predicting low altitude micrometeoroid and debris environments and characterized debris degradation of pristine and space-aged (LDEF) optical samples
- o Develop and update survivability technology status reports for GBR, GSTS, and ROC-COMM
- o Assessments of advanced/emerging survivability technologies in other countries
- o Development and maintenance of nuclear weapon environment and effects simulations and kinetic debris simulation.
- o Development of operation in a nuclear environment (OPINE) algorithms for system simulations (e.g. level 2 system simulation and extended air defense testbed simulation)
- o Conducted pre- and post tests for optical material characterization for AGT/UGT testing
- o Conducted predeployment survivability countermeasures and threat assessment
- o Initiated GBR propagation emulator development
- o Tested RF technology and countermeasures
- o Developed specific technologies and design guidelines for countermeasures to a reconnaissance surveillance and target acquisition sensor
- o Developed Nuclear weapons effects impact assessments on discrimination and classification algorithms for NMD GBR
- o Conducted above ground tests (AGTs) of interceptor and surveillance component electronics
- o Completed development of portable optical radiation/radar
- o Completed Data reduction and analysis of optical and electronic test data from Hunter's Trophy underground test
- o Developed methodologies and simulations for prioritization of conventional, chemical, biological, and RF survivability enhancement options within operational and logistic constraints
- o Provided electromagnetic environmental effects boards to THAAD, ERINT, Corps SAM, GBR, AOC-COMM, targets and GBI and conducted assessments of specific E3 issues
- o Supported GBR, GBI and GSTS design reviews of survivability enhancement options
- o Developed hardened design for analog signal processor in a surveillance sensor

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Project Number: 1501  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

Program Element: 0603216C/0603217C

PE Title: Theater Missile Defense / Ballistic Missile Defense (U)

- (U) 0
- FY 1994 Plans:
- 0 Identify sea-based and joint service BMC3 systems for survivability evaluation
  - 0 Develop Survivability test criteria for sea-based and joint service BMD BMC3 systems
  - 0 Conduct laboratory demonstration of thin film limiting device
  - 0 Conduct Acquisition and Tracking Experiment on MSTI 2 satellite
  - 0 Provide MSTI 3 flight hardware for survivability experiments and evaluate the performance of MSTI 3 on-board hardening devices
  - 0 Design MSTI 4 flight hardware for survivability
  - 0 Release EDGES Version 1.5 which permits SEO impact calculations for seekers subsystem
  - 0 Complete ACE development and conduct initial HWIL ECCM/Decoy SEO assessments
  - 0 Upgrade ACE capability to engage non-domestic ARMs employing unique guidance and signal processing techniques
  - 0 Conduct GBR Discrimination and Tracking mitigation SEO development
  - 0 Develop software for GBR Block II - mitigate nuclear propagation effects and weather effects
  - 0 Complete E3 updates for all TMD elements
  - 0 Complete CCD SEO definition for TMD UOE's
  - 0 Maintain survivability technical information center
  - 0 Design SW/HW for Radar Propagation Evaluation in Nuclear Environment
  - 0 Complete kinetic impact debris distribution model
  - 0 Electromagnetic effects and E3RB support
  - 0 Assessment of technology, planning and travel for NMD technology readiness programs
  - 0 Terminate nuclear, RF and space debris protection technology efforts for BMD space assets

- (U) 0
- FY 1995 Plans:
- 0 Validate verification tests and survivability demonstrations of sea-based and joint service BMC3 systems
  - 0 Conduct Acquisition and Tracking Experiment on MSTI 3 and MSTI 4 satellites
  - 0 Evaluate the performance of MSTI 4 on-board mitigation devices

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C/0603217C

PE Title: Theater Missile Defense / Ballistic Missile Defense (U)

Project Number: 1501  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

- o Release EDGES integrated interceptor version which includes RF seeker and endo environments
- o Use ACE and develop initial ARM ECCM techniques for GBR, PATRIOT and other TMD program radars
- o Integrate ACE and RFSS Anechoic test facility
- o Publish initial HATMD CCD and conventional hardening SEO design guidelines for EMD
- o Integrate corruptor hardware/software into GTF
- o Develop and test discrimination algorithms and advance tracking algorithms
- o Provide E3 annual assessments for ERINT, THAAD, ROC/COMM, GBR, Corpssam, and TMD target
- o Conduct SAR countermeasures POP test
- o Develop and validate RF countermeasures to RF weapons

(U) Program Plan to Completion: This is a continuing program.

D. (U) WORK PERFORMED BY:

- o Naval Command, Control and Ocean Surveillance Center
- o Air Force Space and Missile Systems Center, Phillips Laboratory, Wright Laboratory
- o United States Army Space and Strategic Defense Command
- o United States Army Research Laboratories
- o Defense Nuclear Agency
- o Missile and Space Intelligence Command

E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

1. TECHNICAL CHANGES: A small survivability effort was initiated as a result of the successful MSTI 1 flight experiment and the subsequent MSTI flight opportunities. This MSTI survivability effort was initiated in June 1993. A program was initiated in October 1993 to support the survivability of sea-based BMD elements. Sea-based elements will be assessed for possible vulnerabilities and survivability

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Project Number: 1501  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

Program Element: 0603216C/0603217C

PE Title: Theater Missile Defense / Ballistic Missile Defense (U)

enhancements will be identified and recommended, as appropriate, leveraging on previous research performed for ground and space-based systems.

2. SCHEDULE CHANGES:

3. COST CHANGES: The reduction in total funding by approximately 75% has resulted in cancellation of major parts of the program and slippage of most remaining milestones. All survivability efforts in support of space Missile Tracking Sensors (MTS) in nuclear and RF environments has been canceled, and efforts in supporting space MTSs in laser environments has been reduced to a minimum. For ground-based elements, Integrated Effects Testing for Survivability (INETs), nuclear effects of electronics and optics, SEOs for operation in nuclear environments, and SEOs against unconventional warfare have been cancelled, and all other work has been severely reduced.

F. (U) PROGRAM DOCUMENTATION:

o Survivability Technology Program Master Plan 2Q/FY94

G. (U) RELATED ACTIVITIES:

o Defense Nuclear Agency

PE No. 0602715H

(U) The DNA generic research and development program supports efforts to provide the technology base for the nuclear survivability of all U.S. weapons systems. It supports above ground testing and test facility upgrades, high fidelity calculation of nuclear environments, and system hardness validation methodologies. Technology programs are coordinated with BMDO and a memorandum of understanding executed to preclude duplication of effort and provide POM leverage of DNA generic efforts.

o Air Force Satellite Systems Survivability

PE No. 0603438F

(U) The Air Force Satellite Systems Survivability Program directs research and development studies, analyses, planning and demonstrations for technologies to improve the survivability of US military space systems against current and future threats.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C/0603217C

PE Title: Theater Missile Defense / Ballistic Missile Defense (U)

Project Number: 1501  
Budget Activity: 03  
Adv Technology Dev (U)

H. (U) OTHER APPROPRIATION FUNDS: None

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: BMD0 Cooperative Research Exchange with United Kingdom  
Ministry of Defense (SCORE).

J. (U) MILESTONE SCHEDULE:

0	Thin film limiting device demonstration	2Q/FY94
0	MSTI 2 Acquisition and Tracking Experiment	3Q/FY94
0	Deliver MSTI 4 Flight Hardware	4Q/FY94
0	Achieve ACE IOC	1Q/FY94
0	Begin GBR ARM countermeasures HWIL testing	2Q/FY94
0	Complete ACE Upgrade for additional threat ARMS	3Q/FY94
0	Conduct limited SAR countermeasures POP test	3Q/FY94
0	Complete integrated CCD/Armor SEO Design	3Q/FY94
0	Provide BM/C3 user demo	4Q/FY94
0	Develop initial ARM CM algorithms	4Q/FY94
0	Complete initial CCD SEO definition for	4Q/FY94
0	Upper Tier Theater Missile Defense UOES	4Q/FY94
0	Complete E3 Updates for TMD	4Q/FY94
0	Release EDGES Version 1.5 which includes SEO	4Q/FY94
0	SEO Impact Calculations for Seeker Subsystem	4Q/FY94
0	Provide GBR user demo	4Q/FY94
0	Complete initial CorpsSam SEO Study	1Q/FY94
0	MSTI 4 Acquisition and Tracking Experiment	2Q/FY95
0	Integrate ACE and MICOM RFSS Anechoic facility	2Q/FY95

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C/0603217C

PE Title: Theater Missile Defense / Ballistic Missile Defense (U)

Project Number: 1502  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

A. (U) RESOURCES:  
Project Title:

(\$ in Thousands)  
Lethality and Target Hardening

	FY1993 Actual	FY1994 Estimate	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	Total Program Continuing
0603216C RDT&E	26,320	29,064	32,800	29,400	28,200	25,300	15,800	
0603217C RDT&E	10,776	1,358	0	0	1,000	1,800	2,000	

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) The Lethality of BMD weapons is a measure of BMD systems effectiveness in fulfilling defense mission requirements. The Lethality and Target Hardening program is developing a necessary and sufficient understanding of physical principles involved in defensive weapon/target interaction, target response and kill modes, and impact signatures for discrimination and damage assessment.

(U) This task provides supporting lethality technology for developmental ballistic missile defense ground based kinetic energy weapons and directed energy weapons. This supporting lethality technology includes lethality phenomenology analyses and tests to evaluate kinetic energy warheads hit-to-kill interceptors and laser effectiveness against simulated threats. Theater threats include conventional, chemical, biological, and nuclear warheads. Common validated lethality criteria for a high confidence kill against any/all threat warheads is required. These lethality criteria are developed in coordination with TMD interceptor development. Lethality of the interceptors will be validated in cooperation with interceptor demonstration/validation flight test and evaluations.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C/0603217C

PE Title: Theater Missile Defense / Ballistic Missile Defense (U)

Project Number: 1502  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1993 Accomplishments:

- o (\$10,914) Conducted scaled hit-to-kill impact on chemical threat warheads, initiated a test series to quantify submunition kill mechanisms and demise parameters to develop lethality criteria for the TMD chemical threat warheads.
- o (\$4,262) Conducted laboratory scaled tests of biological threat targets and simulants to support definition of lethality criteria for the TMD biological threat warheads.
- o (\$3,407) Conducted scaled test of fragments and hit-to-kill impacts on TMD nuclear threats and HE submunition threat targets to develop criteria for HE initiation and dismemberment of these threats.
- o (\$4,161) Conducted full-scale, high resolution sled impact tests of TMD interceptors against high fidelity threat warheads, completed test series for ERINT and developed capability to simulate THAAD engagement parameters.
- o (\$1,040) Provided direct support to TMD systems (ERINT and Patriot) flight tests-with target materials, lethality data collection and analysis.
- o (\$2,536) Published baseline TMD lethality criteria document, supported PAC-3 acquisition process by providing accredited lethality models, and conducted atmospheric transport analysis and modeling.
- o (\$9,397) Conducted high explosive initiation testing, ARE-2N and ARE-2HK flight tests, hit-to-kill impact tests of medium and large RVs, and PBV tests to extend strategic nuclear target lethality technology.
- o (\$1,379) Performed lethality criteria development, kill assessment, photonic hit indicator (PHI) development and sensitivity analysis for strategic nuclear target lethality assessment and modeling.

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## FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C/0603217C

PE Title: Theater Missile Defense / Ballistic Missile Defense (U)

Project Number: 1502  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

- (U) FY 1994 Plans:
- 0 (\$8,232) Conduct scaled hit-to-kill impact on chemical threat warheads, complete a test series to quantify submunition kill mechanisms and demise parameters to develop lethality criteria for the TMD chemical threat warheads, conduct aerobreakup reverse ballistic tests.
  - 0 (\$3,375) Conduct laboratory scaled tests of biological threat targets and simulants, define response to impact environment and develop accepted simulants for alternate threat agents and initiate testing on them, to support definition of lethality criteria for the TMD biological threat warheads.
  - 0 (\$2,717) Conduct scaled tests of fragments and hit-to-kill impacts on TMD nuclear threats and HE submunition threat targets to continue development of lethality criteria for HE initiation and dismemberment of these threats.
  - 0 (\$1,210) Provide direct support to TMD system flight tests - with target materials, lethality data collection and analysis, prepare for support of THAAD flight tests.
  - 0 (\$5,170) Conduct full-scale, high resolution sled impact tests of the THAAD interceptor against high fidelity threat warheads.
  - 0 (\$2,250) Conduct scaled hit-to-kill gun tests to evaluate interceptor mass, velocity, and geometry lethality trades, conduct parametric sensitivity study to evaluate influence of threat variations/uncertainties on interceptor lethality.
  - 0 (\$500) Conduct ground effects study to quantify collateral effects from intercepts of chemical and biological submunition threat warheads.
  - 0 (\$650) Conduct tri-service evaluation, verification, and validation of atmospheric transport codes for evaluation of collateral effects from chemical and biological threat warheads following intercept.
  - 0 (\$750) Evaluate lethality enhancement techniques (EFP, enhanced penetration fragments, multi-fragment high explosive initiation, and reactive fragments).
  - 0 (\$4,210) Publish update to the baseline TMD lethality criteria document, support PAC-3 acquisition process by providing accredited lethality models, and conducted atmospheric transport.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C/0603217C  
PE Title: Theater Missile Defense / Ballistic Missile Defense (U)

Project Number: 1502  
Budget Activity: 03  
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February 1994

- o (\$1,358) Complete planned strategic nuclear target lethality assessment and modeling, to include reduction of data from ARE-2HK Flight tests and scaled SLBM PBV impact tests, and update aerothermal/structural demise lethality criteria.

(U) FY 1995 Plans:

- o (\$6,000) Continue effort to expand TMD chemical target lethality technology into broader threat set, and examine hardening concepts that can be employed to enhance threat performance and mitigate against engagement effects.
- o (\$6,500) Continue effort to expand TMD biological target lethality technology, with evaluation of alternate threat materials and the effect of hardening and alternative threat bomblet and dissemination concepts, complete test series to define biological submunition kill mechanism and demise parameters.
- o (\$3,300) Continue testing to support lethality criteria development against the TMD ROW nuclear threats, and continue testing against hardened TMD HE threats.
- o (\$3,500) Provide direct support to THAAD system flight tests, with target materials, lethality data collection and analysis, includes surviving submunition dispersal experiments.
- o (\$3,000) Complete full-scale, high resolution sled impact tests of the THAAD interceptor against high fidelity threat warheads, employ counterfire techniques to replicate engagement dynamics at intercept.
- o (\$3,000) Continue evaluation of lethality enhancement designs and warhead concepts for increase of interceptor lethality.
- o (\$2,500) Continue ground effects study and test to quantify collateral effect from intercepts of chemical and biological submunition threat warheads and develop predictive models for post-engagement threat and hazard, support integration into lethality assessment code architecture.
- o (\$5000) Continue TMD lethality assessment and modeling effort, publish lethality criteria for low mass interceptor, sponsor accreditation of lethality analysis software for use in THAAD acquisition milestone support.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C/0603217C

PE Title: Theater Missile Defense / Ballistic Missile Defense (U)

Project Number: 1502  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

(U) Program Plan to Completion: This is a continuing program.

D. (U) WORK PERFORMED BY:

(U) In-house:

- o Defense Nuclear Agency
- o U.S. Air Force's Wright Labs - Eglin AFB
- o U.S. Army Space and Strategic Defense Command

(U) Major Contractors:

- o Kaman Sciences Corp. - AL and CO
- o Science Applications International Corp. - NC and FL
- o Teledyne Brown Engineering - AL
- o Battelle Memorial Institute - AL and OH
- o General Research Corp. - CA

E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

- 1. TECHNICAL CHANGES
- 2. SCHEDULE CHANGES:
- 3. COST CHANGES:

F. (U) PROGRAM DOCUMENTATION:

- o Preliminary TMD Lethality Criteria Report 2Q/FY91
- o TMD Lethality Criteria Update 3Q/FY91
- o NMD Assessment 4Q/FY92
- o Baseline TMD Lethality "Design To" Criteria 1Q/FY93

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C/0603217C

PE Title: Theater Missile Defense / Ballistic Missile Defense (U)

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0	TMD Lethality Sensitivity Study	1Q/FY94
0	Updated Aerothermal Demise Criteria	2Q/FY94
0	Preliminary Assessment of GBI vs. SLBM	4Q/FY94
0	Revised Strategic Target Lethality Criteria	2Q/FY95

G. (U) RELATED ACTIVITIES: None

H. (U) OTHER APPROPRIATION FUNDS: None

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

J. (U) MILESTONE SCHEDULE:

0	Sled track ERINT HTK lethality tests	2-4/FY92
0	Baseline TMD Lethality Criteria for all threats	1Q/FY93
0	Full-scale ERINT sled lethality tests	1-4Q/FY93
0	Execute ARE-2N flight test	2Q/FY93
0	Validation of pitch-down concept, THAAD sled tests	3-4Q/FY93
0	Execute ARE-2HK flight test	4Q/FY93
0	Conduct RV Donor/Acceptor test	3Q/FY93
0	Support Multi-Mode Patriot intercept	1Q/FY94
0	Conduct scaled GBI vs. SLBM impact tests	1Q/FY94
0	TMD lethality criteria update	1Q/FY94
0	Sled track THAAD HTK lethality tests	1-4Q/FY94
0	TMD lethality flight test support	1-4Q/FY94
0	Continue full scale TMD-HTK sled/gun tests	1-4Q/FY94
0	Publish updated aerothermal demise criteria	2Q/FY94
0	Continue TMD lethality flight test support	1-4Q/FY95

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C/0603217C

PE Title: Theater Missile Defense / Ballistic Missile Defense (U)

Project Number: 1502  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

- |   |   |           |
|---|---|-----------|
| 0 | Publish revised strategic target lethality criteria | 2Q/FY95   |
| 0 | Complete full scale sled/gun tests                  | 4Q/FY95   |
| 0 | Continue TMD lethality flight test support          | 1-4Q/FY96 |

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1503  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

A. (U) RESOURCES: (\$ in Thousands)  
Project Title: Power and Power Conditioning

Program Name:	FY1993	FY1994	FY1995	FY1996	FY1997	FY1998	FY1999	Total
0603217C RDT&E	Actual	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Program
	41,229	7,060	10,000	10,000	10,000	10,000	10,000	Continuing

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) Currently, the program focuses on space nuclear power, specifically the TOPAZ International Program (TIP). The TIP consists of three major components: an extensive series of non-nuclear ground tests to understand the capabilities and limitations of the TOPAZ II thermionic system, basic research with an international team of thermionic and materials experts, and critical component design for increased power generation (the 40kW program) using knowledge gained from the TOPAZ II design.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1993 Accomplishments:

- o (\$4,000) Completed six full power ground tests on two unfueled TOPAZ reactor systems using electric heaters.
- o (\$2,000) Initiated TOPAZ component testing, and materials research on Thermionic Fuel Elements (TFEs).
- o (\$1,500) Completed conceptual design of reactor safety modification to meet US safety standards.

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## FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1503

Budget Activity: 03

Adv Technology Dev (U)

February 1994

- o (\$7,789) Completed safety assessments for potential applications of TOPAZ II thermionic system.
- o (\$15,320) Completed Preliminary Design Review (PDR) for the Nuclear Electric Propulsion Spaceflight Test Program (NESTP) (Note: activity on this task cancelled 10/93 due to budget reductions).
- o (\$2,120) Developed higher efficiency solar cells and twenty different solar cell experiments for the Space Test Research Vehicle (STRV).
- o (\$6,000) Completed purchase of initial two TOPAZ II thermionic power systems via contract between BMD0 and ISP/Inertek
- o (\$2,500) Developed two independent conceptual designs (multi-cell thermionics vs. single-cell thermionics) for the 40kW upgrade.

### (U) FY 1994 Plans:

- o (\$2,500) Complete second 1000 hour full power ground test of unfueled TOPAZ II thermionic system using electric heaters.
- o (\$1,000) Initiate TOPAZ II power system shock and vibration tests.
- o (\$1,500) Downsize 40kW upgrade program to concentrate on critical component testing.
- o (\$1,500) Complete development of prototype digital Reactor Control Unit (RCU) and Tacitron thermionic power conditioning switch.
- o (\$560) Continue TOPAZ component testing and materials research on Thermionic Fuel Elements (TFEs).

### (U) FY 1995 Plans:

- o (\$10,000) Consolidate ongoing international joint technology development programs within BMD0, including the TOPAZ International Project (TIP) into one clearly identifiable category. Specific efforts to be carried forward are to be chosen based on Congressional, OSD, and BMD0 guidelines and 1994 test results.

- (U) Program Plan to Completion: This is a continuing program.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C  
PE Title: Ballistic Missile Defense (U)

Project Number: 1503  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

D. (U) WORK PERFORMED BY:

- o Air Force Phillips Laboratory, Kirtland AFB, NM
- o Department Of Energy (DOE), Germantown, MD
- o Sandia National Laboratory, Albuquerque, NM
- o Los Alamos National Laboratory, Los Alamos, NM
- o Applied Physics Laboratory, Laurel, MD
- o Rocketdyne Division of Rockwell, Inc., Canoga Park, CA
- o Space Power Inc. (SPI), San Jose, CA
- o Babcock & Wilcox, Lynchburg, VA
- o General Atomics, San Diego, CA

E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

- 1. TECHNICAL CHANGES: None
- 2. SCHEDULE CHANGES: None

3. COST CHANGES: The \$70 million (87%) budget reduction in FY94 and reductions in future years have necessitated a revamping of the program. All conventional power development (solar cells and batteries) has been eliminated. The Nuclear Electric Power (NEP) space flight test has been cancelled, along with all work on development of the satellite, and integration of propulsion systems for the flight test. The remaining program, the TIP, only includes non-nuclear ground tests and basic research.

F. (U) PROGRAM DOCUMENTATION: All projects require final reports upon conclusion of project.

G. (U) RELATED ACTIVITIES: Related activities include many projects within all Program Elements. There is no unnecessary duplication of effort within BMDO or the DoD, although related thermionic research is being conducted with USAF funds under PE 63401 and PE 62302.

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Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1503  
Budget Activity: 03  
Adv Technology Dev (U)  
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H. (U) OTHER APPROPRIATION FUNDS: None

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

J. (U) MILESTONE SCHEDULE:

0

TIP:

Initiate TOPAZ thermionic system shock and vibration testing  
Initiate Reactor Control Unit (RCU) testing with TOPAZ ground test  
Downsize and refocus 40kW upgrade research to meet budget constraints  
Complete prototype development of second generation tacitron

2Q/1994  
4Q/1994  
2Q/1994  
4Q/1994

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## FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C  
PE Title: Ballistic Missile Defense (U)

Project Number: 1504  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

### A. (U) RESOURCES: (\$ in Thousands) Materials and Structures

Program Name:	FY1993		FY1994		FY1995		FY1996		FY1997		FY1998		FY1999		Total	
	Actual	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Program	Continuing
0603216C RDT&E	0	800	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0603217C RDT&E	23,915	5,609	7,000	11,000	8,200	8,000	7,000	8,000	7,000	8,000	7,000	8,000	7,000	8,000	7,000	Continuing

### B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) The Materials and Structures (M&S) Project conducts research, development and flight and ground test demonstrations in lightweight structural materials, adaptive structures technology, propulsion/thermal/ optical materials, tribomaterials, superconductor devices, and space environmental effects.

(U) M&S supports Sensors and Interceptor activities through the application of advanced materials and structures development and manufacturing technologies to element designs. These efforts will provide for exposure of critical material samples to the natural space environment, reduce vibration through the application of improved active and passive damping material, provide lightweight ultra stiff one step producible composite structures and non contaminating optical baffles.

(U) Follow-On M&S projects focus on providing advance materials and structures technology demonstrations to meet the extreme pointing and tracking, secure communications and enhanced discrimination requirements of near and far term BMDO systems as they mature in development. To gain confidence in the ability of these systems to operate in the natural and threat environments, requires demonstration of advanced composite and adaptive structure technologies. Superconducting devices are also manufactured and demonstrated to provide orders of magnitude increased capabilities in secure communications and target discrimination.

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## FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1504

Budget Activity: 03

Adv Technology Dev (U)

February 1994

(U) M&S projects focus on providing advisory services and critical data on lightweight advanced composite structures for theater interceptor systems. These efforts provide independent assessments and assist in identifying structural components and subsystems where interceptor system weight can be reduced in a cost effective manner. Candidate items will be fabricated to demonstrate performance and manufacturability.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

### C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

#### (U) FY 1993 Accomplishments:

- o (\$2.620M) Complete ground demonstration of flight hardware (Actex 2) for the STEP III mission of a stabilized solar array using advanced materials and vibration suppression techniques.
- o (\$.800M) Pressure Test movable C-C rocket nozzle for GBI interceptors.
- o (\$.370M) Fabricate, optically characterize, and deliver baffles for Clementine spacecraft.
- o (\$2.630M) Ground test flight hardware for satellite attack warning and assessment flight experiment (SAWAFE) for the STEP III.
- o (\$.230M) Initiate development of a modular, space qualified, integrated adaptive structure vibration control patch.
- o (\$2.060M) Integration of active vibration controlled cryocooler and micro-electronic space experiments for STRV-1B U.K. satellite.
- o (\$3.050M) Provide overall Space Environmental support to all BMDO programs.
- o (\$.800M) Continued TECHSHOT Endo and Exo advance material and optics sounding rocket test planning.
- o (\$.950M) Terminated all HTS 60 GHz communications applications efforts by end of FY93.

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## FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C  
PE Title: Ballistic Missile Defense (U)

Project Number: 1504  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

- o (\$1.350M) Restructured 10K LTS analog signal processor element efforts to delay end to end demo of on-FPA digital signal processing.
- o (\$570M) Rescoped advanced optical baffles program to delay demos of flight quality baffles for interceptor and space surveillance systems.
- o (\$6.120M) Modified advanced composites program to delay demos of low cost fabrication of advanced composite structures for interceptors and satellites.
- o (\$620M) Reprogrammed tribology program to delay completion of dry lubricant bearing tests.
- o (\$900M) Initiate planning for Multi-national Defense Research (MDR/STRV2) satellite.
- o (\$485M) Continued interceptor diamond window characterization program.
- o (\$360M) Terminated superconducting cavity oscillator and silica nitride injector efforts by end of FY93.

### (U) FY 1994 Plans:

- o (\$1.096M) Deliver first SAMMES materials experiment for the STEP III mission.
- o (\$930M) Deliver SAWAFE experiment for STEP III mission.
- o (\$842M) Deliver ACTEX II experiment for STEP III mission.
- o (\$58M) Conduct on orbit ACTEX experiment.
- o (\$500M) Provide overall space environmental effects and green manufacturing support to all BMDO programs.
- o (\$619M) Conduct STRV-1b flight experiment.
- o (\$550M) Continue 10K low temperature superconductor (LTS) analog signal processor demonstration program for on-FPA processing for space surveillance systems.
- o (TBD) Initiate ground and flight testing program for advanced Endo interceptors structures.
- o (TBD) Continue development and initiate design for the US/UK experiment module (formerly MDR/STRV2).
- o (TBD) Initiate fabrication of second ship set for the Space Active Modular Materials Experiment for US/UK experiment module.
- o (\$500M) Conduct High Temperature Composite Characterizations for THAAD.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1504  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

- 0 (\$ .300M) Develop large scale low cost sapphire window for THAAD.
  - 0 (TBD) Develop manufacturable weight reducing structural components for Patriot.
  - 0 (\$ .568M) Hot Fire CC flexseal nozzle.
  - 0 (TBD) Draft comprehensive ground space radiation test protocol.
  - 0 (0) Terminate dry lubricant ultra-low friction bearing fatigue test ground demonstration.
  - 0 (\$ .196M) Continue diamond window and baffles technology development.
  - 0 (\$ .250M) Continue advanced composites for interceptors and satellites program.
  - 0 (TBD) Develop joint advanced composite structures program.
  - 0 (TBD) Develop joint superconductor demo program.
- (U) FY 1995 Plans:
- 0 (\$ .250M) Complete Space Environmental Effects AO protocol Design Guide.
  - 0 (\$ .900M) Develop flight test articles of advanced optical baffles for ground based interceptor and space based surveillance systems.
  - 0 (\$ .700M) Develop advanced composite flight test articles for of GBI-X kill vehicle (KV) structure.
  - 0 (\$ .300M) Develop lightweight, lower power "smart patch" to control vibration and adjust on-orbit dynamic behavior of spacecraft.
  - 0 (TBD) Continue development of weight reducing structural components and structure for PATRIOT.
  - 0 (\$ .700M) Demonstrate integral airframe with heatshield for theater interceptors.
  - 0 (TBD) Develop weight reducing structures for TMD-GBR.
  - 0 (\$2.500M) Initiate fabrication of US/UK experiment module
  - 0 (\$ .250M) Develop radiation effects testing protocol for space surveillance electronic components.
  - 0 (\$ .300M) Data collection and analysis for STRV-1B and STEP III flight.
  - 0 (TBD) Conduct joint advanced composite interceptor structure tests.
  - 0 (TBD) Conduct superconducting test on LIS FPA test bed.
  - 0 (TBD) Initiate ground and flight testing program for advanced Endo interceptors structures.
  - 0 (\$ .500M) Demonstrate end-to-end photons to digital bits integrated 10k superconducting FPA array with signal processor.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1504  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

0 (\$ .600M) Conduct STEP III flight experiments.

(U) Program Plan to Completion: This is a continuing program.

D. (U) WORK PERFORMED BY:

0 Los Alamos National Laboratory - Los Alamos, NM  
0 Oak Ridge National Laboratory - Oak Ridge, TN  
0 Spire Corporation - Bedford, MA  
0 FMI - Biddeford, MA  
0 Westinghouse - Baltimore, MD  
0 Hughes - Los Angeles, CA  
0 Lockheed - Sunnyvale, CA  
0 Martin-Marietta - Denver, CO  
0 Physical Sciences Incorporated - Andover, MA  
0 TRW - Los Angeles, CA  
0 SPARTA - San Diego, CA  
0 JET Propulsion Laboratory - Pasadena, CA  
0 Boeing - Seattle, WA  
0 Sandia Lab - Albuquerque, NM  
0 Naval Research Laboratory, Washington, DC

E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

1. TECHNICAL CHANGES: None.  
2. SCHEDULE CHANGES: None.  
3. COST CHANGES: None.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1504  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

F. (U) PROGRAM DOCUMENTATION:

(U) BMDO Test and Evaluation Master Plan 11/88  
(U) Space Materials Selection Guide 3Q/FY90-91

G. (U) RELATED ACTIVITIES:

(U) The M&S Project draws upon the materials and structures technology base of the nation and conducts cooperative programs with the Services and Federal Agencies. Critical/enabling technology demonstrations are planned in support of projects within most program elements. Unnecessary duplication of efforts are avoided within BMDO and the DoD by M&S program coordination with the Joint Directors of Laboratories technical program for advanced materials.

H. (U) OTHER APPROPRIATION FUNDS: None

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: STRV MLA

J. (U) MILESTONE SCHEDULE:

0	Sled test of two color GBI window	1Q/FY92
0	Deliver baffle components for AGTs	2Q/FY92
0	Fly passive materials panel (EOIM-3)	4Q/FY92
0	Complete tests of stabilized solar array	4Q/FY92
0	Demonstrate 10K LTS Multiplexer operation	4Q/FY92
0	Fabricate/test 10GHz HTS Cavity	1Q/FY93
0	Complete Optical/Thermal Tests on Diamond Window	4Q/FY93
0	Complete End-to-End LTS LWIR sensor demo	4Q/FY95
0	Flight test GrTp interstage structure	1Q/FY94

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1504  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

0	Demo LTS shift register at 10K	4Q/FY93
0	Fly ACTEX II adaptive structures experiment	4Q/FY94
0	Complete Space Environmental AO Protocol	3Q/FY95
0	Ground demonstration of "smart patch" vibration/structural control capability and durability	4Q/FY95
0	Fly the first SAMMES materials experiment	4Q/FY94
0	Flight test SAWAFE	4Q/FY94
0	On-orbit demonstration of adaptive in-line truss struts	4Q/FY96
0	First all composite interceptor structure	4Q/FY96
0	manufactured by automated match metal molding	4Q/FY95
0	Integral airframe/heatshield for THAAD	4Q/FY94
0	Deliver lightweight components to PATRIOT	2Q/FY95
0	Final report for STRV-1B flight experiment	2Q/FY95
0	Final report for STEP III mission experiments	2Q/FY96
0	US/UK experiment module flight	4Q/FY96
0	Fly first Endo interceptor test bed	2Q/FY96

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0602217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1601  
Budget Activity: 02  
Exploratory Development (U)  
February 1994

A. (U) RESOURCES: (\$ in Thousands)  
Project Title: Innovative Science and Technology (IS&T)

Program Name:	FY1993 Actual	FY1994 Estimate	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	Total Program Continuing
0602217C RDT&E	80,048	41,510	60,000	60,000	60,000	60,000	60,000	

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

- (U) Explore innovative science and engineering for several technologies of interest to BMD0.
- (U) Invest seed money in high-risk technologies that could dramatically change how BMD develops. Cause and exploit breakthroughs in science to keep BMD at the foremost edge of what is possible. Conduct proof-of-concept demonstrations that transitions technology to development programs.
- (U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1993 Accomplishments:

- o (\$11.5M) Advanced Processing - Demonstrated the first gigabit per second optical fiber link between two remote massively parallel computers and demonstrated new optoelectronic computer with 10,000 times faster throughput than its successor, heralding the age of general-purpose optical processing.

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## FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0602217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1601  
Budget Activity: 02  
Exploratory Development (U)  
February 1994

- o (\$21.9M)Sensor and Detection - Launched POAM onboard the French SPOT-4 satellite and Demonstrated autodyne Doppler laser tracking system for missile plumes and hardbodies.
- o (\$10.81M)Power - Launched SPEAR-3 to validate techniques for isolating high voltage and amperage under space conditions.
- o (\$13.4M)Materials - Demonstrated rapid densification of carbon-carbon.
- o (\$16.84M)Propellants - Demonstrated 50% efficient Hall Space Thruster, conducted combustion tests of propellants formulated using ammonia dinitramide, and conducted 4000 hour life test on 1.3kW Stationard Plasma Thruster.
- o (\$5.6M)Directed Energy - Mountain-to-mountain test of the high data-rate laser satellite communication system.

### (U) FY 1994 Plans:

- o (\$6.1M)Advanced Processing - Wafer integration of 3-dimensional neural network computer for a fast-frame seeker, and first integration of superconducting analog to digital converters, correlators, phase shifters, etc., for 60 GHz spread spectrum communications.
- o (\$13.8M)Sensor and Detection - Complete critical design review of Skipper satellite to obtain aerothermochemistry data, conduct Stereo Track of "Scud debris" in sensor fusion experiment at ISTEf, and demonstrate the use of Golay cell detectors for low power, continuous, "sentry mode" operation at ambient temperature for bell-ringer surveillance unit for Hall Electric Thruster and (\$3.91M)Power - Demonstrate 95% efficient power conditioning unit for Hall Electric Thruster and complete ground test of concentrator photovoltaic power panel.
- o (\$4.1M)Materials - Demonstrate an inexpensive, high-resolution imaging 640 x 480 Silicon based LWIR focal plane array, and demonstrate an uncooled ultraviolet focal plane array compatible with conventional IR readout technology using diamond and gallium detectors.
- o (\$10.3M)Propellants - Perform small rocket motor demonstration of ammonium dinitramide base propellant.
- o (\$3.3M)Directed Energy - Develop 2 x 200 mW diode laser for high-data-rate satellite laser communications system.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0602217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1601

Budget Activity: 02

Exploratory Development (U)

February 1994

(U) FY 1995 Plans:

(U) Program Plan to Completion: This is a continuing program.

D. (U) WORK PERFORMED BY: Industry, academe, and government laboratories.

E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

1. TECHNICAL CHANGES: Impact of reducing the budget from \$83M in FY93 to \$41M in FY94: 1) Curtails aggressive actions to transition research successes to industry and to complete early proof-of-concept demonstrations. 2) Cancels portions of focused basic research program and eliminates 80 university contracts plus 20 other contracts with industry. Technologies taking largest cuts: Miniature divert propulsion system, Spread spectrum rapid communication, Non-volatile and robust fault-tolerate computer memories, Fast frame seeker for intelligent pattern recognition, Sensor fusion for sorting "Scud breakup debris", Materials for low mass interceptors.

2. SCHEDULE CHANGES: To sustain the programs to exploit the successes, most of the demonstration and transition programs will be stretch 12 to 18 months.

3. COST CHANGES: The cancellations will produce close-out type costs of about \$5M. The stretch-out will increase demonstration program costs about 10%.

F. (U) PROGRAM DOCUMENTATION: IST Brochure (Program Information Booklet).

G. (U) RELATED ACTIVITIES: Supports all BMDO technologies. There is no unnecessary duplication of effort within BMDO or the DoD.

H. (U) OTHER APPROPRIATION FUNDS: None

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0602217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1601  
Budget Activity: 02  
Exploratory Development (U)  
February 1994

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

J. (U) MILESTONE SCHEDULE: None

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0602217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1602

Budget Activity: 02

Exploratory Development (U)

February 1994

A. (U) RESOURCES:

(\$ in Thousands)

Project Title: Small Business Innovative Research

Program Name:	FY1993 Actual	FY1994 Estimate	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	Total Program Continuing
0602217C RDT&E	40,162	31,543	46,460	46,774	53,820	56,521	54,773	

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) Explore innovative concepts pursuant to PL102-564 which mandates a 2-phase R&S competition for small businesses with innovative technologies.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1993 Accomplishments:

o (\$6M) Private sector funds of \$6M matched BMDO SBIR funds for dual-use development.

o (\$11.4M) 196 Phase I awards were made to 126 firms.

o (\$0.00) Seven small firms went public in 1993 with technologies got their start in BMDO SBIR.

(U) FY 1994 Accomplishments:

o (\$9.543M) 150 Phase I awards to 100 firms.

o (\$22M) 30 Phase II awards to 25 firms.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0602217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1602  
Budget Activity: 02  
Exploratory Development (U)  
February 1994

(U) FY 1995 Accomplishments:

- o (\$12M) 200 Phase I awards to 140 firms.
- o (\$34.460M) 60 Phase II awards to 50 firms.

(U) Program Plan to Completion: This is a continuing program.

D. WORK PERFORMED BY: Various small business firms who compete for awards in 16 R&D topics.

E. COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

- 1. TECHNICAL CHANGES:
- 2. SCHEDULE CHANGES:
- 3. COST CHANGES:

F. (U) PROGRAM DOCUMENTATION:

- o Report to Congress provided through OSD Small and Disadvantaged Business Utilization (SADBU).

G. (U) RELATED ACTIVITIES:

- o All technology programs within BMDO could potentially benefit from these projects. There is no unnecessary duplication of effort within BMDO or the DoD.

H. (U) OTHER APPROPRIATION FUNDS: None

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0602217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1602

Budget Activity: 02

Exploratory Development (U)

February 1994

J. (U) MILESTONE SCHEDULE:

o Products are delivered on a continuing basis as a result of funding various innovative concepts.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1700  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

A. (U) RESOURCES: (\$ in Thousands)  
Project Title: Flight Test / Launch Activities

Program Name:	FY1993 Actual	FY1994 Estimate	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	Total Program Completed
0603217C RDT&E	63,048	42,996	0	0	0	0	0	0

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) Define, develop, and conduct fast-response, ground-based preflight verification and ballistic or space flight testing of unique concepts and high yield approaches for BMD weapons, seekers, and targeting applications that might be deployed beyond the turn of the century in support of Other Follow-On systems. Provide experienced launch and flight test teams including: launch vehicle procurement; launch services; payload processing; payload integration; mission operations/planning; range operations/ integration; mission analysis; and test operations. Four competitive contracts to provide commercial orbital launches exist: two each for 500 and 2500 lb payload classes.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1993 Accomplishments:  
o (\$25M) Complete fabrication of the DC-X.  
o (\$5M) Conducted 3 successful launches of the DC-X.

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## FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1700  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

- o (\$33.048) Began mission planning and flight hardware procurement activities for 3 additional experiments (Clementine I, MSTI 3,4).

### (U) FY 1994 Plans:

- o (4.884M) Completed BMD0 funding of the Single Stage Rocket Technology program.
- o (\$23.112) Began mission planning and flight hardware procurement activities for 2 additional experiments (ORBEX & MSTI 3).
- o (\$15M) Flight of Clementine I to be completed in January 1994.

### (U) FY 1995 Plans:

- o Transfer responsibility of launch vehicle procurement to the payload integrators.

(U) Program Plan to Completion: Project efforts transferred in FY95.

### D. (U) WORK PERFORMED BY:

#### (U) Major Contractors:

- o Orbital Science Corporation, Space Data Division - Phoenix, AZ
- o NASA
- o CTA - Fairfax, VA.
- o Martin Marietta, Astronautics - Denver, CO
- o EER, Seabrook, MD
- o McDonnell Douglas, Huntington Beach, CA

### E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

1. TECHNICAL CHANGES:
2. SCHEDULE CHANGES:

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1700  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

3. COST CHANGES:

F. (U) PROGRAM DOCUMENTATION:

- o Flight Test Services Master Plan
- o Environment Assessment
- o Flight Test Plan
- o Configuration Items Specification
- o Software Requirements Specifications
- o Software Top Level Design Requirement
- o Acceptance Test Plan and Report
- o Flight Test Data Report

G. (U) RELATED ACTIVITIES:

(U) Technology programs are coordinated among DoD and other BMDO agencies to preclude duplication of effort and take advantage of jointly conducted missions wherever practical. BMDO program elements being supported by LCFTS include:

- |      |                         |   |
|------|-------------------------|---|
| 1101 | Passive Sensors         | PE No. 0603214C   |
| 1105 | Discrimination          | PE No. 0603215C   |
| 1110 | Sensor Integration      | PE No. 0603215C   |
| 1201 | Interceptor Comp Tech   | PE No. 0603217C   |
| 1202 | Interceptor Integration | PE No. 0603217C   |
| 1501 | Survivability           | PE No. 0603214C/<br>PE No. 0603215C/<br>PE No. 0603216C |

There is no unnecessary duplication of effort within BMDO or the DoD.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

• Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 1700  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

H. (U) OTHER APPROPRIATION FUNDS:

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) MILESTONE SCHEDULE:

0 Project Clementine  
0 MSTI 3  
0 MSTI 3

2Q/FY94  
3Q/FY94  
3Q/FY94

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604217C

PE Title: Ballistic Missile Defense (U)

Project Number: 2102  
Budget Activity: 04  
Dem/Vol (U)  
February 1994

A. (U) RESOURCES: (\$ in Thousands)  
Project Title: Space-Based Sensor (Brilliant Eyes)

	FY1993	FY1994	FY1995	FY1996	FY1997	FY1998	FY1999	Total
Program Name:	Actual	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Program
0604217C RDT&E	209,900	0	120,000	150,000	150,000	200,000	200,000	4,558M

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENTS AND SYSTEM CAPABILITIES:

(U) Brilliant Eyes (BE) is a satellite sensor system designed to support strategic and theater ballistic missile defense. A constellation of BE satellites provides global (below-the-horizon and above-the-horizon) access of ballistic missiles in their boost, post-boost, and midcourse phases in response to directed tasking from the Command and Control Element (C2E). In addition, BE peacetime operations include monitoring and collecting data on ballistic missiles worldwide and supporting Air Force space surveillance missions.

(U) The Secretary of Defense's Bottom-up Review (BUR) in FY1993 selected a National Missile Defense technology program funded at approximately \$600 million per year as a hedge against the emergence of a greater long-range missile threat than is now projected. The BUR allocated approximately \$200 million annually for acquisition of BE to support National Missile Defense and Theater Missile Defense. Additional DoD guidance has reduced the funding level further delaying the schedule and impacting the acquisition strategy.

(U) BE satellites carry a suite of short-, medium-, and long-wavelength infrared and visible sensors. These sensors acquire and track ballistic missiles in the boost phase and continue tracking and discriminating the reentry vehicles from debris and penetration aids throughout the ballistic flight of the missiles. The satellites are in low earth orbits to track above-the-horizon in the midcourse phase

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604217C

PE Title: Ballistic Missile Defense (U)

Project Number: 2102  
Budget Activity: 04  
Dem/Vol (U)  
February 1994

of the missile trajectories. The shorter ranges, compared to high altitude (geosynchronous) early warning satellites, and above-the-horizon viewing allow the BE sensors to track ballistic missiles after the boosters stop burning and the missile bodies cool to provide highly accurate estimates of the missile trajectories to support ballistic missile defense. BE can either be cued by an early warning sensor, such as DSP or its follow-on, or can be actively monitoring small areas of interest in anticipation of missile launches.

(U) BE tracking data supports active defense, passive defense, attack operations and command and control. BE continually tracks ballistic missiles in flight to support situational awareness, apportionment, and support the optimum allocation of defense assets. BE allows the interceptors (Ground Based Interceptors, Theater High Altitude Area Defense and Sea Based Upper Tier) to have the maximum time for fly-out, generating the maximum possible defended area from each interceptor site. BE cues radars (Ground Based Radars and ship based) increasing their detection range by focusing their energy to smaller volumes to acquire targets earlier. The interceptors can be launched and updated based on BE track data. BE data can be converted into accurate reentry vehicle impact point and time predictions enabling defensive measures to be taken. Precise and timely launch point estimates, in theaters of interest, enable prompt counterstrikes against missile launchers.

(U) During peacetime BE monitors ballistic missile tests worldwide collecting threat development, deployment, signature and trajectory data. This allows defenses to maintain and optimize their effectiveness as new threats appear. In addition, BE tracks satellites for cataloging and warning to fill voids and greatly improve the Air Force space surveillance network.

(U) The major programmatic and technical objectives addressed by this program include: (1) demonstrate technology maturity, performance at natural space radiation levels, producibility, and lifetimes of focal plane arrays, cryocoolers, communication components and processors; (2) validate sensor and satellite designs and performance with real-time simulations and hardware-in-the-loop brassboards; (3) demonstrate

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604217C

PE Title: Ballistic Missile Defense (U)

Project Number: 2102  
Budget Activity: 04  
Dem/Val (U)  
February 1994

critical system capabilities, functions, and distributed sensor tracking performance with on-orbit satellites; (4) substantiate affordability by validating cost models based on fabrication of critical technology components; (5) demonstrate cost effective supportability by validating maintenance and support concepts that integrate product development practices and procedures; (6) demonstrate that the operational BE system design satisfies the following Critical Operational Issues (COIs): operational performance, command, control, and communication, suitability, interoperability and positive control.

(U) The test program for BE includes computer simulations, ground demonstrations, and flight demonstrations to collect data and demonstrate the technical maturity of the BE program for a Milestone II decision and an early 2000s deployment.

(U) BE funding includes work being performed to develop BMDO sensor test capabilities at Arnold Engineering Development Center (AEDC) and develop the space-based visible (SBV) sensor at MIT/Lincoln Laboratory. Two existing sensor test chambers at AEDC are being upgraded, the 7V chamber and the 10V chamber. The 7V chamber will be used principally for calibration of surveillance sensors (such as BE) and seeker testing (such as GBI or THAAD). The 10V chamber will be used to perform end-to-end functional and performance characterization and testing of surveillance sensors. These ground test capabilities are required for BE and support other BMDO programs. SBV is a visible sensor on the Midcourse Space Experiment (MSX) to demonstrate space surveillance functions and the utility of augmenting infrared data with visible data.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604217C

PE Title: Ballistic Missile Defense (U)

Project Number: 2102

Budget Activity: 04

Dem/Va1 (U)

February 1994

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1993 Accomplishments:

- o (\$172.7M) Awarded two BE Dem/Va1 Step 02 prime contracts to: (1) Design, fabricate, launch and test BE Flight Demonstration System (FDS) satellites to demonstrate critical functions, collect target and background phenomenology data, and demonstrate technology and (2) conduct ground demonstrations of key technologies and producibility. Completed BE FDS System Design Review and A-level system specifications and began life testing of 65 Kelvin mechanical cryocoolers.
- o (\$20.6M) Continued 10 Kelvin sorption cryocooler development and began brass-board fabrication and assembly, developed infrared sensors for data collection and functional demonstration from airborne-based or space-based platforms, and developed BE system simulation for testing at National Test Facility.
- o (\$11.0M) Completed AEDC 7V & 10V sensor test chamber upgrades Critical Design Reviews and purchased hardware necessary for chamber upgrades.
- o (\$5.6M) SBV sensor fabrication completed, delivered for integration on MSX, and integration testing initiated.

(U) FY 1994 Plans:

- o (\$0M) BE was transferred to the Air Force PE 63440F in FY94. BE will be transferred back to BMDO in FY95. (1) Restructure contracts due to funding reductions; (2) Continue life testing 65 Kelvin cryocoolers; (3) Achieve 7V sensor test chamber initial operational capability and complete vacuum, vibration isolation, and cryogenic systems for 10V chamber; (4) Demonstrate focal plane arrays, processors, and 60 GHz communication components functionality at natural environments radiation levels; (5) Demonstrate initial digital End-to-End Real-Time Simulation (ETERTS) in support of FDS satellite design; (6) Complete ABM treaty compliance review for operational system.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604217C

PE Title: Ballistic Missile Defense (U)

Project Number: 2102  
Budget Activity: 04  
Dem/Val (U)  
February 1994

FY 1995 Plans:

- (U) o (\$112.4M) Complete BE FDS Preliminary Design Review (PDR) and B-level development specifications;  
(2) Exercise contract option with one contractor to build FDS satellites; (3) Purchase flight pacing hardware items for BE FDS satellites; (4) Perform critical performance and producibility demonstrations on focal plane arrays, processors, and 60 GHz communication components; (4) Continue life testing 65 Kelvin cryocoolers; and (5) Demonstrate End-to-End Sensor Demonstration (ETESD) hardware-in-the-loop test to validate sensor hardware and software designs, performance and operations.
- o (\$1.6M) SBV launched aboard MSX spacecraft; sensor check-out and calibration; commence SBV operations, data collection and data reduction.
- o (\$6.0M) Complete integration of optics in 10V sensor test chamber and continue scene simulation hardware development.

(U) Program Plan To Completion: This is a continuing program.

D. WORK PERFORMED BY:

- (U) o Major Contractors:  
Rockwell International, Space Systems Division
- o TRW, Inc./Hughes Aircraft

(U) o Developing Organization:  
Air Force Space and Missile Systems Center/MGS - Los Angeles, CA

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604217C

PE Title: Ballistic Missile Defense (U)

Project Number: 2102  
Budget Activity: 04  
Dem/Val (U)  
February 1994

E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY

1. (U) TECHNICAL CHANGES:  
0 None

2. (U) SCHEDULE CHANGES:  
a The funding and program guidance from the BUR caused a one and a half year delay to the operational system design and development. The Demonstration/Validation Flight Demonstration System satellites will be launched with only a slight delay.

3. (U) COST CHANGES:  
a Additional DoD guidance and POM funding reductions required a downselect to a single contractor flight demonstration and deferral of the objective system design and LWIR sensor ground demonstrations.  
o There are no BMDO funds for BE in FY94 due to Congressional Appropriation direction placing BE in an Air Force Program Element with the Defense Support Program and the Follow-on Early Warning System. DoD intends to transfer the program back to BMDO in FY95.

F. (U) PROGRAM DOCUMENTATION:

o BE Technical Requirements Document, 19 Mar 92  
o BE System Performance Specification, 19 Mar 92  
o BE Element Requirements Document, 3 Feb 93  
o BE Cost Analysis Requirements Document, 18 May 93  
o BE Test and Evaluation Master Plan, 26 Apr 93

G. (U) RELATED ACTIVITIES:

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## FY1995 RDT&E DESCRIPTIVE SUMMARY

Project Number: 2102  
Budget Activity: 04  
Dem/Val (U)  
February 1994

Program Element: 0604217C  
PE Title: Ballistic Missile Defense (U)

0	1101	Passive Sensors	BA	6.4
0	1104	Signal Processing	BA	6.4
0	1105	Discrimination	BA	6.4
0	1106	Sensor Studies & Experiments	BA	6.4
0	1405	Communication Engineering	BA	6.4
0	1501	Survivability Tech	BA	6.4

There is no unnecessary duplication of effort within BMD0 or the DoD.

H. (U) OTHER APPROPRIATION FUNDS: None

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

J. (U) MILESTONE SCHEDULE:

0	BE FDS ABM Treaty Compliance Review	4Q/FY93
0	Operational System ABM Treaty Compliance Review	1Q/FY94
0	BE Program Requirements Review	2Q/FY94
0	7V Chamber Upgrade Capability Available	2Q/FY94
0	BE FDS Preliminary Design Review	1Q/FY95
0	Execute contract option for FDS satellite fabrication	1Q/FY95
0	BE FDS Critical Design Review	2Q/FY96

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 2103

Budget Activity: 03

Adv Technology Dev (U)  
February 1994

A. (U) RESOURCES:  
Project Title:

(\$ in Thousands)  
Ground-Based Surveillance and Tracking System

Program Name: 0603217C RDT&E	FY1993		FY1994		FY1995		FY1996		FY1997		FY1998		FY1999		Total	
	Actual		Estimate		Estimate		Estimate		Estimate		Estimate		Estimate		Program	Completed
	11,500		0		0		0		0		0		0		0	

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) The primary role of the Ground-Based Surveillance and Tracking System (GSTS) was to provide tracking and discrimination data for the Ground Based Interceptor (GBI). Based upon the U.S. Space Command operational concepts, cost comparison, and coverage comparison, Brilliant Eyes (BE) was selected to provide tracking and discrimination to GBI. GSTS was then considered as an option for interim cueing of GBI at the initial site, prior to deployment of BE. In this case again an alternative source, Early Warning Radars, was found to be cheaper and have better coverage than GSTS. Therefore, the interim cueing of GBI will be done by upgrades to the Early Warning Radars. GSTS is no longer required to support National Missile Defense (NMD).

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1993 Accomplishments:  
o (\$11.5M) Delivery of completed hardware and software and termination of GSTS contract.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Project Number: 2103  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

Program Element: 0603217C  
PE Title: Ballistic Missile Defense (U)

- (U) FY 1994 Plans: None
- (U) FY 1995 Plans: None
- (U) Program Plan to Completion: None
- D. WORK PERFORMED BY:
  - (U) Major Contractors:  
McDonnell Douglas Space Systems Co. - Huntington Beach, CA
  - (U) Subcontractors:
    - o Hughes Aircraft Co. - El Segundo, CA
    - o Honeywell, Inc. - Clearwater, FL
    - o TRW, Inc. - Huntsville, AL
    - o SPARTA, Inc. - Huntsville, AL
    - o Space Data - Chandler, AZ
    - o Rockwell - Anaheim, CA
  - (U) In-House Support:
    - o USASDC - Huntsville, AL (Project Office)
    - o Teledyne Brown Engineering (SETA) - Huntsville, AL
    - o Nichols Research (SETA) - Huntsville, AL
- E. COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

- 1. TECHNICAL CHANGES:
- 2. SCHEDULE CHANGES:

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## FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 2103

Budget Activity: 03

Adv Technology Dev (U)

February 1994

### 3. COST CHANGES:

#### F. (U) PROGRAM DOCUMENTATION:

0	GSTS Program Plan	6/91
0	GSTS Nuclear Guidelines	7/91
0	GSTS Cost Analyst Requirements Document	10/91
0	GSTS Initial NMD Card, Draft	11/91
0	GSTS Technical Requirements Document	12/91
0	GSTS Test and Evaluation Master Plan	12/91

#### G. (U) RELATED ACTIVITIES:

0	1101 Passive Sensors	PE No. 0603215C
0	3103 Measurement Standards	PE No. 0603215C
0	3107 Siting and Facilities	PE No. 0603218C
0	3306 Advanced Research Center	PE No. 0603218C

There is no unnecessary duplication of effort within BMD0 or the DoD.

#### H. (U) OTHER APPROPRIATION FUNDS: None

#### I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

#### J. (U) MILESTONE SCHEDULE:

0	System Preliminary Design Review	2Q/FY92
0	Sensor Hardware and Software Critical Design Reviews	3Q/FY92

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 2103  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

0 System Critical Design Review  
0 Contract Completed

4Q/FY92  
3Q/FY93

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C/0604225C/0603217C

PE Title: Theater Missile Defense / Ballistic Missile Defense (U)

Project Number: 2104  
Budget Activity: 03/04  
Adv Technology Dev /  
Dem/Val(U)  
February 1994

A. (U) RESOURCES: (\$ in thousands)  
Project Title: Ground-Based Radar

Program Name:	FY1993 Actual	FY1994 Estimate	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	Total Program
0208060C PROC	0	0	0	0	0	15,424	189,289	3,750M
0603217C RDT&E	82,480	24,849	8,000	11,000	20,000	20,000	26,000	Continuing
0604216C RDT&E	112,095	234,000	173,200	157,450	49,220	11,390	0	
0604225C RDT&E	0	0	0	9,790	145,130	150,880	123,240	

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) The Theater Missile Defense Ground Based Radar (TMD-GBR) is the theater radar supporting the Theater High Altitude Air Defense (THAAD) system. The TMD-GBR meets an immediate requirement for a more capable wide-area-defense radar to provide surveillance and fire control support to the Theater High Altitude Area Defense (THAAD) missile system in the UTMDS architecture and to provide cueing support to lower tier systems such as PATRIOT. The TMD-GBR utilizes state-of-the-art radar technology to accomplish its required functions of threat attack early warning, threat type classification, interceptor fire control, external sensor cueing, and launch and impact point estimation. Of particular note will be TMD-GBR's capability to perform threat classification against theater tactical ballistic missiles, and then, kill assessment after intercept. In addition to providing fire control support for THAAD and cueing support to the lower tier, the TMD-GBR will also have residual capability against air-breathing threats. Starting in FY 1995, the TMD-GBR Demonstration/Validation (Dem/Val) and User Operational Evaluation System (UOES) radars will be tested at the White Sands Missile Range (WSMR) in New Mexico.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C/0604225C/0603217C

PE Title: Theater Missile Defense / Ballistic Missile Defense (U)

Project Number: 2104  
Budget Activity: 03/04  
Adv Technology Dev /  
Dem/Val(U)  
February 1994

(U) Family of Radars Design Concept:

(U) The design and fabrication of the TMD-GBR and the NMD-GBR radars are based upon the family of modular X-band radars concept. The TMD-GBR radar's antenna technology is based upon the use of solid state transmit and receive modules. The NMD-GBR radar has been restructured into a radar technology demonstration program. The objective of this restructured effort is to resolve the following critical NMD-GBR technology issues: discrimination, target object map, mechanical or electrical scan, and kill assessment. Using the *Defense Planning Guidance*, an incremental program will be developed which leverages advances under the TMD-GBR program to resolve these issues which are applicable to NMD. This program structure, by leveraging TMD developments, provides a cost-effective method for resolving the NMD-GBR critical issues and allows the government both flexibility and limited liability as this program evolves.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1993 Accomplishments:

- o Completed Dem/Val preliminary design review (PDR).
- o Completed UOES system design review (SDR).
- o Completed Dem/Val critical design review (CDR).
- o Completed UOES PDR.
- o Completed solid state demonstration array PDR.
- o Initiated fabrication of Dem/Val radar.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C/0604225C/0603217C

PE Title: Theater Missile Defense / Ballistic Missile Defense (U)

Project Number: 2104  
Budget Activity: 03/04  
Adv Technology Dev /  
Dem/Val(U)  
February 1994

- o Completed negotiation for TMD-GBR test facility and developed test plans for WSMR functional testing.

(U) FY 1994 Plans:

- o Continue TMD-GBR Dem/Val radar fabrication and perform contractor in-plant testing.
- o Deliver Increment 1 and 2 software.
- o Begin construction of WSMR facilities.
- o Conduct TMD-GBR UOES CDR.
- o Begin TMD-GBR UOES fabrication.
- o Continue solid state demonstration array risk reduction program and establish pilot production lines for modules and complete design of demonstration array.
- o Continue operations in nuclear environments, electronic countermeasures, electronic counter-countermeasures, and antiradiation missile performance analyses.
- o Begin detailed planning for engineering and manufacturing development phase.

(U) FY 1995 Plans:

- o Complete fabrication and testing of in-plant TMD-GBR Dem/Val unit.
- o Deliver Dem/Val unit to White Sands Missile Range (WSMR) and perform integration and test activities to confirm operational status of unit and suitability for further testing.
- o Initiate functional test and validation at WSMR with THAAD system.
- o Complete fabrication and inplant testing of UOES radars.
- o Continue solid state demonstration array module production, test demonstration array, and validate module production line.
- o Continue operations in nuclear environments, electronic countermeasures, electronic counter-countermeasures, and antiradiation missile performance analyses.
- o Continue detailed planning for engineering and manufacturing development phase.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C/0604225C/0603217C

PE Title: Theater Missile Defense / Ballistic Missile Defense (U)

Project Number: 2104  
Budget Activity: 03/04  
Adv Technology Dev /  
Dem/Val(U)  
February 1994

- o Continue construction of WSMR facilities.

(U) Program Plan To Completion: These are continuing programs.

D. (U) WORK PERFORMED BY:

- o U.S. Army PEO Missile Defense - Huntsville, AL
- o U.S. Army Space and Strategic Defense Command - Huntsville, AL
- o U.S. Army Missile Command - Redstone Arsenal, AL
- o Raytheon (Family of Radars Dem/Val contract) - Wayland, MA

E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

1. TECHNICAL CHANGES: Initiated contract modifications to incorporate wideband tracking and imaging capabilities which necessitated the addition of a fourth computer to the signal processing subsystem.
2. SCHEDULE CHANGES: The TMD-GBR Dem/Val and TMD-GBR UOES programs remain on schedule.
3. COST CHANGES: No significant cost changes occurred.

F. (U) PROGRAM DOCUMENTATION:

- o TMD-GBR Technical Requirements Document (TRD) - 1/92
- o Family of Radars Dem/Val Contract - 9/92
- o TMD-GBR Cost Analysis Requirements Document (CARD) - 6/93
- o Family of Radars CARD - 6/93
- o UTTMDS TEMP - 11/91
- o High Altitude Theater Missile Defense (HATMD) Operational Requirements Document - 3/92

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C/0604225C/0603217C

PE Title: Theater Missile Defense / Ballistic Missile Defense (U)

Project Number: 2104  
Budget Activity: 03/04  
Adv Technology Dev /  
Dem/Val(U)  
February 1994

G. (U) RELATED ACTIVITIES:

o 1102 Radar	PE No. 6.3
o 1105 Discrimination	PE No. 6.3
o 1501 Survivability	PE No. 6.3
o 2104 GBR	PE No. 6.3/6.4/6.5
o 2210 THAAD	PE No. 6.4/6.5
o 3300 Test and Evaluation Support	PE No. 6.3
o 4100 Program Management	PE No. 6.6

There is no unnecessary duplication of effort within BMD0 or the DoD.

H. (U) OTHER APPROPRIATION FUNDS: Procurement: FY1998 \$15.424M; FY 1999 \$189.289M.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

J. (U) MILESTONE SCHEDULE:

o GBR solicitation package to industry	2Q/FY92
o UTTMDS MS I (TMD-GBR) Defense Acquisition Board	2Q/FY92
o Family of Radars contract award	4Q/FY92
o TMD-GBR Dem/Val CDR	4Q/FY93
o TMD-GBR UOES CDR	1Q/FY94
o TMD/GBR Dem/Val system delivered to WSMR	3Q/FY95
o TMD-GBR UOES delivered to WSMR (two systems)	1Q/2Q/FY96

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604216C/0604225C

PE Title: Theater Missile Defense (U)

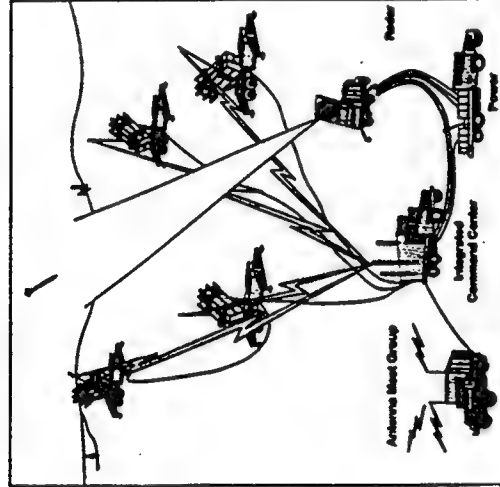
Project Title: PATRIOT ONLY (ERINT NOT INCLUDED)

Project: 2207

Budget Activity: 04/05

Dem/Val / EMD (U)

February 1994



POPULAR NAME: PATRIOT ONLY (ERINT NOT INCLUDED)

A. (U) SCHEDULE/BUDGET INFORMATION: (\$ in Thousands)

BUDGET	FY 1993		FY 1994		FY 1995		FY 1996		FY 1997		FY 1998		FY 1999		Program Total
	Dem/Val	EMD	Dem/Val	EMD	Dem/Val	EMD	Dem/Val	EMD	Dem/Val	EMD	Dem/Val	EMD	Dem/Val	EMD	
Major Contract	63,870	0	48,074	37,367	52,340	192,400	25,960	181,220	0	95,330	0	27,840	0	0	
Support Contract	3,500	0	3,060	1,260	2,800	2,900	900	4,300	0	5,400	0	5,600	0	0	
In-House Support	10,400	0	11,350	1,470	8,000	15,300	3,900	10,600	0	13,100	0	4,300	0	0	
GFE/Other	16,700	0	18,200	2,000	6,100	6,600	200	9,500	0	20,400	0	6,700	0	0	
Total	94,470	0	80,684	42,097	69,240	217,200	30,960	205,620	0	134,230	0	44,440	0	0	4,253M

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604216C/0604225C

PE Title: Theater Missile Defense (U)

Project Title: PATRIOT ONLY (ERINT NOT INCLUDED)

Project: 2207  
Budget Activity: 04/05  
Dem/Val / EMD (U)  
February 1994

SCHEDULE	FY 1993	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	Complete
Program Milestones	GEN MS III IPR	PAC-3 Missile MS IV ASARC (1Q) DAB (2Q)	C-1 Software Release (1Q)	PDB-4 Software Release (1Q) PAC-3 Missile LRIP (1Q)	PAC-3 Missile MS III (4Q)	PDB-5 Software Release (4Q)		
Engineering Milestones			RE III System Evaluation (1Q)	CDI-II System Evaluation (1Q)				
T&E Milestones	Dem/Val Flight Tests (1-4Q)		C-2 CDT&E (2Q) EMD Flight Tests (2-4Q)	C-2 FOT (1Q) EMD Flight Tests (1-4Q)	EMD Flight Tests (1-3Q) IOT&E (2Q)	C-3 CDT&E (1Q) C-3 FOT (3Q)		
Contract Milestones		PAC-3 Missile EMD Contract (3Q)	RE-III Prod. Contract (2Q)	PAC-3 Missile LRIP Contract (1Q)	PAC-3 Missile Prod. Contract (4Q)			

Note: Costs do not include procurement.

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) PATRIOT is a long-range, mobile, field Army and Corps air defense system, which uses guided missiles to simultaneously engage and destroy multiple targets at varying ranges. Current threat theater ballistic missiles (TBMs) with significantly improved range and accuracy have increased the threat against PATRIOT air defense sites or defended assets. This could result in the destruction of air defense sites and provide the enemy air superiority once an attack is initiated. The current PATRIOT missile requires improved performance and increased accuracy to counter the evolving threat and to increase its contribution to the lower tier of the theater segment of a theater missile defense (TMD) system. The PATRIOT missile program, which entered production in 1979, is a major defense acquisition

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604216C/0604225C

PE Title: Theater Missile Defense (U)

Project Title: PATRIOT ONLY (ERINT NOT INCLUDED)

Project: 2207

Budget Activity: 04/05

Dem/Va1 / EMD (U)

February 1994

program (MDAP). It has successfully evolved through two major improvement programs, PATRIOT Anti-Tactical Missile (ATM) Capability (PAC) 1 and 2. Also, as a result of analysis of PATRIOT operations in Desert Storm, the Quick Response Program (QRP) was initiated to incorporate several near-term hardware/software changes to upgrade PATRIOT performance. The PAC-3 Growth Program is the latest evolution of the phased material change improvement program to PATRIOT. The material changes represent capability improvements to address the PAC-3 Operational Requirements Document (ORD) and are planned over a multi-year period. Fielding will range from the already funded QRP beginning in FY 1993 for near-term deployment, to the Configuration 3 of the PAC-3 Program ending in FY 1999 for the far-term deployment. The program elements funded by the Ballistic Missile Defense Organization (BMDO) for TMD improvements are: radar enhancements (QRP); guidance enhancement missile (GEM); multimode missile or ERINT; radar enhancements phase III; remote launch; communications upgrades; and THAAD integration/cueing.

(U) The major technical issue associated with this program, as with other interceptor programs, is the lethality of the missile. Two missiles are competing for selection as the PAC-3 missile. ERINT, developed by Loral Vought Systems, is a BMDO-sponsored advanced technology program to exploit hit-to-kill technology. The Multimode Missile, developed by Raytheon, is a variant of the PATRIOT missile and incorporates an active Ka-band seeker, improved propulsion system, and aimable warhead. A selection decision on the PAC-3 missile is scheduled for second quarter of FY 1994. In the event that ERINT is selected as the PAC-3 missile, integration studies are being conducted to develop a definitive concept for a fully integrated PATRIOT/ERINT system of sufficient depth to support program planning, cost estimating, development, and testing.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604216C/0604225C

PE Title: Theater Missile Defense (U)

Project Title: PATRIOT ONLY (ERINT NOT INCLUDED)

Project: 2207

Budget Activity: 04/05

Dem/Va1 / EMD (U)

February 1994

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1993 Accomplishments:

- o Continued PAC-3 missile review process.
- o Initiated Phase III Radar integration testing.
- o Continued Remote Launch development.
- o Completed multimode missile propellant formulation and characterization.
- o Conducted two GEM flight tests.
- o Completed two test flights of the multimode seeker.
- o Provided Multimode Missile data to support PAC-3 missile decision process and Cost and Operational Effectiveness Analysis (COEA).
- o Continued to execute PATRIOT-ERINT Integration Program.

(U) FY 1994 Plans:

- o Complete PAC-3 missile review process.
- o Complete Post Deployment Build-4 (PDB-4) software testing.
- o Complete Multimode Missile propellant, case, and motor development and tests.
- o Complete Multimode Missile improved warhead development and test.
- o Plan and schedule PAC-3 missile controlled test vehicle flights.
- o Complete Radar Enhancements Phase III subsystem testing and integration.
- o Complete GEM flight test program and conduct production decision review.
- o Continue Remote Launch development.
- o Provide any additional Multimode Missile data required to support the PAC-3 Informed Missile Decision process (ASARC/DAB).
- o Complete the PATRIOT-ERINT integration program.
- o Complete Producibility Engineering and Planning (PEP) and Manufacturing Plan.
- o Continue logistics planning/LSA/LSAR/training and technical manual support.
- o Initiate system integration and testing.

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U N C L A S S I F I E D

FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604216C/0604225C

PE Title: Theater Missile Defense (U)

Project Title: PATRIOT ONLY (ERINT NOT INCLUDED)

Project: 2207  
Budget Activity: 04/05  
Dem/Val / EMD (U)  
February 1994

- o Initiate hardware/software developmental testing.

(U) FY 1995 Plans:

- o Begin GEM delivery.
- o Conduct Phase III Radar production decision review.
- o Obtain Configuration 1 software release.
- o Complete PDB-4 software testing.
- o Complete Remote Launch integration and testing.
- o Initiate PAC-3 Missile EMD flight test program.
- o Continue system integration and testing.
- o Continue hardware/software developmental testing.
- o Continue logistics planning/LSA/LSAR/training and technical manual support.

- (U) Program Plan to Completion: This is a continuing program.

D. (U) WORK PERFORMED BY:

(U) In-house:

- o Program Executive Office, Missile Defense - Arlington, VA
- o Project Manager, PATRIOT/Product Manager, PATRIOT ATM - Redstone Arsenal, AL
- o U.S. Army Missile Command Research, Development, and Engineering Center - Redstone Arsenal, AL
- o U.S. Army Armament Research and Development Center - Picatinny Arsenal, NJ
- o Harry Diamond Laboratories - Adelphi, MD
- o Ballistic Research Laboratory - Aberdeen Proving Ground, MD
- o U.S. Army Air Defense School - Fort Bliss, TX

(U) Contractors:

- o Raytheon Corporation (prime) - Andover, MA

U N C L A S S I F I E D

U N C L A S S I F I E D

FY1995 RDT&E DESCRIPTIVE SUMMARY

Project: 2207  
Budget Activity: 04/05  
Dem/Val / EMD (U)  
February 1994

Program Element: 0604216C/0604225C

PE Title: Theater Missile Defense (U)

Project Title: PATRIOT ONLY (ERINT NOT INCLUDED)

- o Martin-Marietta - Syracuse, NY
- o Thiokol - Ogden, UT
- o Telefunken System Technik - Germany

E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

- 1. TECHNICAL CHANGES: None
- 2. SCHEDULE CHANGES: None
- 3. COST CHANGES: None

F. (U) PROGRAM DOCUMENTATION:

- o ATMD O&O Plan - 8/90
- o PAC-3 ORD - 5/92
- o Cost/Schedule Status Report - monthly

G. (U) RELATED ACTIVITIES:

- o 1502 Lethality and Target Hardening
  - o 2208 ERINT
  - o 2210 THAAD
  - o 2212 Corps SAM
  - o 3300 Test and Evaluation Support
  - o NATO Cooperative Programs
  - o Joint Tactical Missile Defense Program
- PE No. 6.3  
PE No. 6.3  
PE No. 6.4/6.5  
PE No. 6.3/6.4/6.5  
PE No. 6.3

- H. (U) OTHER APPROPRIATION FUNDS: Procurement: FY93: \$75.2M; FY94: \$120.719M; FY95: \$255.063M; FY96: \$435.622M; FY97: \$386.515M; FY98: \$470.651M; FY99: \$439.878M.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604216C/0604225C

PE Title: Theater Missile Defense (U)

Project Title: PATRIOT ONLY (ERINT NOT INCLUDED)

Project: 2207

Budget Activity: 04/05

Dem/Va1 / EMD (U)

February 1994

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS:

- o Extended Air Defense Memorandum of Agreement between the United States and the Federal Republic of Germany, 17 May 89, with Annex A: Multimode Seeker Demonstration

J. (U) TEST AND EVALUATION DATA:

- o Multimode seeker Dem/Va1 flight tests
- o PAC-3 ASARC
- o PAC-3 DAB
- o Conduct IPF/PEP production transition
- o PDB-4 software system demonstrations
- o Phase III radar mod kit PPQT
- o PATRIOT-ERINT Integration Program
- o PAC-3 missile EMD flight test program
- o PDB-4 software release
- o Initiate long lead procurement PAC-3 missile
- o PAC-3 missile IOTE
- o PAC-3 missile Milestone III FRP decision
- o PDB-5 software Follow-on Test (FOT)
- o PDB-5 software release

2Q/FY92 - 1Q/FY94  
1Q/FY94  
2Q/FY94  
1Q/FY94 - 3Q/FY96  
2Q/FY94 - 4Q/FY94  
3Q/FY94 - 4Q/FY94  
2Q/FY91 - 4Q/FY94  
2Q/FY95 - 3Q/FY97  
1Q/FY96  
4Q/FY96  
2Q/FY97  
4Q/FY97  
3Q/FY98  
4Q/FY98

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# U N C L A S S I F I E D

## FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604216C

PE Title: Theater Missile Defense (U)

Project Title: ERINT

Project: 2208  
Budget Activity: 04  
Dem/Val (U)  
February 1994

### A. (U) RESOURCES: (\$ in Thousands) Project Title: Extended Range Interceptor (ERINT)

	FY1993	FY1994	FY1995	FY1996	FY1997	FY1998	FY1999	Total
<u>Program Name:</u>	<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Program</u>
0604216C RDT&E	116,210	97,000	58,460	19,580	9,760	0	0	Continuing

(These figures do not include target monies (Project 3304))

### B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES

(U) The purpose of this project is to fund the development of the Extended Range Interceptor (ERINT) Program. It is intended to demonstrate that ERINT is an effective defensive weapon for the lower tier of the integrated theater missile defense (TMD) segment of the BMD0 architecture.

(U) The ERINT program will demonstrate a small, agile, hit-to-kill missile that will provide an asset defense against incoming maneuvering and non-maneuvering TBMs. A secondary objective of the program is to provide defense against air-breathing threats. The missile combines several state-of-the-art technologies, including an onboard active millimeter wave seeker that provides endgame guidance, advanced flight control technologies for agility in terminal maneuvers, lethality enhancement technologies, and a lightweight composite case solid rocket motor. The ERINT missile has been designed to integrate easily with existing air and missile defense capabilities such as Patriot, and is a technology capable of integration into the Navy AEGIS weapon system.

(U) The ERINT flight test program is comprised of eight flight tests during FY92-94. Results from these tests, from accompanying simulation and other analyses, and from ongoing acquisition planning, analysis, and trade studies being performed by US Army organizations will be used to establish the ERINT acquisition strategy. On the basis of ERINT test results, high fidelity simulations, and cost and

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# U N C L A S S I F I E D

## FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604216C

PE Title: Theater Missile Defense (U)

Project Title: ERINT

Project: 2208

Budget Activity: 04

Dem/Val (U)

February 1994

operational effectiveness studies, the U.S. Army and BMDO will determine the future acquisition strategy. These flight tests will also gather critically needed lethality data required to validate the hit-to-kill concept and establish "common kill" criteria against a variety of maneuvering and non-maneuvering TBM threats (chemical and biological, both bulk and submunition).

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

### C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

#### (U) FY 1993 Accomplishments:

- o Conducted first guided intercept of a LANCE target (GTF-1).
- o Provided data to support the PAC-3 missile decision process and Cost and Operational Effectiveness Analysis (COEA).
- o Completed the ERINT Cost Analysis Requirements Description (CARD).
- o Continued to execute the PATRIOT/ERINT Integration Program.
- o Verified the utility of the USMC TPS-59 radar to adapt ERINT for USMC ATBM capability.
- o Continued the development of the ERINT Technology Program with flight tests against ballistic and air-breathing targets.
- o Determined root cause and implemented corrections for GTF-1 miss.
- o Continued hardware/software developmental testing.

#### (U) FY 1994 Accomplishments/Plans:

- o Conducted first successful intercept of a surrogate threat TBM containing simulated chemical submunition payload.
- o Demonstrated hit-to-kill lethality against a submunition threat.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604216C

PE Title: Theater Missile Defense (U)

Project Title: ERINT

Project: 2208  
Budget Activity: 04  
Dem/Val (U)  
February 1994

- o Continue to demonstrate hit-to-kill capability of ERINT against submunition and bulk chemical targets.
- o Continue the development of the ERINT technology program with a test against an air-breathing target.
- o Provide data to support the PAC-3 informed missile decision process (ASARC/DAB).
- o Complete PATRIOT/ERINT Integration Program.
- o Demonstrate hit-to-kill capability of ERINT against maneuvering targets.
- o Complete the flight test program.
- o Complete producibility engineering and planning (PEP) and manufacturing plan.
- o Initiate EMD or risk reduction program.
- o Continue hardware/software developmental testing.
- o Continue logistics planning/LSA/LSAR/training and technical manual support.

(U) FY 1995 Plans:

- o Initiate hardware-in-the-loop (HWIL) testing.
- o Initiate ERINT command and launch system testing.
- o Initiate EMD flight test program.
- o Continue hardware/software developmental testing.
- o Continue logistics planning/LSA/LSAR/training and technical manual support.

(U) Program Plan to Completion: This is a continuing program.

D. WORK PERFORMED BY:

- o Loral Vought Systems Corporation - Arlington, TX
- o Rockwell International - Anaheim, CA and Duluth, GA
- o Atlantic Research Corp. - Gainesville, VA
- o AEG - Germany
- o SEP - France

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# U N C L A S S I F I E D

## FY1995 RDT&E DESCRIPTIVE SUMMARY

Project: 2208  
Budget Activity: 04  
Dem/Val (U)  
February 1994

Program Element: 0604216C  
PE Title: Theater Missile Defense (U)  
Project Title: ERINT

### E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY

1. TECHNICAL CHANGES: None
2. SCHEDULE CHANGES: None
3. COST CHANGES: None

### F. (U) PROGRAM DOCUMENTATION:

- 0 ERINT OPSEC Plan - 7/89
- 0 ERINT Statement Of Work - 8/88
- 0 ERINT Quality Control Program Plan - 9/88
- 0 Data Accession List - monthly
- 0 Cost/Schedule Status Report - monthly
- 0 Configuration Management Plan - 1/90

### G. (U) RELATED ACTIVITIES:

- 0 1502 Lethality and Target Hardening
- 0 2207 PATRIOT
- 0 2210 THAAD
- 0 2212 Corps SAM
- 0 3300 Test and Evaluation Support

PE No. 6.3  
PE No. 6.4/6.5  
PE No. 6.4/6.5  
PE No. 6.4/6.4/6.5  
PE No. 6.3

There is no unnecessary duplication of effort within BMDO or the DoD.

### H. (U) OTHER APPROPRIATION FUNDS: None

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# U N C L A S S I F I E D

## FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604216C

PE Title: Theater Missile Defense (U)

Project Title: ERINT

Project: 2208  
Budget Activity: 04  
Dem/Val (U)  
February 1994

### I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS:

- o Memorandum of Understanding (MOU) dated March 1986 concerning participation of German industries in BMD0 research.
- o General Security of Military Information Agreement of September 1977 for French participation.

### J. (U) MILESTONE SCHEDULE:

- o PATRIOT/ERINT Integration Program
  - o ERINT Dem/Val Flight Test Program
  - o PAC-3 ASARC
  - o PAC-3 DAB
  - o EMD Flight Test Program
  - o PAC-3 missile initial operational test and evaluation
  - o PAC-3 missile Milestone IV
- 2Q/FY91 - 4Q/FY94  
3Q/FY93 - 4Q/FY94  
2Q/FY94  
2Q/FY94  
2Q/FY96 - 1Q/FY98  
4Q/FY97 - 1Q/FY98  
2Q/FY98

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U N C L A S S I F I E D

FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C

PE Title: Theater Missile Defense (U)

Project Number: 2209  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

A. (U) RESOURCES: (\$ in Thousands)  
Project Title: Arrow Continuation Experiments (ACES)

	FY1993	FY1994	FY1995	FY1996	FY1997	FY1998	FY1999	Total
<u>Program Name:</u>	<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Program</u>
0603216C RDT&E	57,776	61,424	52,400	45,000	40,000	45,000	50,000	Continuing

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) The Arrow Continuation Experiments (ACES) Program is a U.S.-Israeli initiative designed to provide Israel with a basis for an informed engineering and manufacturing decision for an area tactical ballistic missile defense capability and to provide the U.S. with technology information and data. This program is a follow-on demonstration phase for Arrow interceptor development. Critical lethality tests are being conducted in the initial phase of this program using the Arrow I missile developed during the Arrow program. An Arrow II missile is being designed and will be tested for an increased engagement envelope. If successful, the Arrow II will satisfy the Israeli requirement for an interceptor for defense of military assets and population centers and will support U.S. technology base requirements for new advanced antitactical ballistic missile technologies that could be incorporated into the TMD layered defense system.

(U) The Arrow Deployability Program beginning in FY94 will pursue the research and development of technologies associated with the deployment of the Arrow system. This effort will include three system-level flight tests of the Arrow II interceptor and launcher supported by the Israeli-developed fire control radar and battle management control center, and studies to define interfaces required for Arrow system interoperability with U.S. TBM systems. Prior to obligation of funds to execute Arrow Deployability Program research and development (R&D) efforts, the President will certify to the Congress that a Memorandum of Agreement (MOA) exists with Israel for these R&D projects, that each project

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C

PE Title: Theater Missile Defense (U)

Project Number: 2209

Budget Activity: 03

Adv Technology Dev (U)

February 1994

provides benefits to the U.S., that the Arrow missile has completed a successful intercept, and that the government of Israel continues to adhere to export control pursuant to the MTCR.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1993 Accomplishments:

(\$53,796) Arrow Continuation Experiments (ACES)

- o Conducted second Arrow intercept test (AIT-2) flight using the Arrow I interceptor against a surrogate target.
- o Continued design of Arrow II interceptor and launcher.
- o Conducted warhead lethality and radome survivability sled test.
- o Conducted force and movement state separation wind tunnel tests.

(\$3,980) ACES Support

- o Initiated use of Arrow data for risk reduction in the THAAD and SM-2 Block IV A programs.
- o Analyzed and reviewed Israeli design and trade studies generated by ACES prior to each subsystem critical design review (CDR).
- o Initiated development of high fidelity seeker models to analyze seeker performance.

(U) FY 1994 Plans:

(\$56,424) Arrow Continuation Experiments (ACES)

- o Conduct first Arrow lethality test (ALT-1) flight using the Arrow I interceptor against a surrogate target carrying a simulated chemical bulk warhead.

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U N C L A S S I F I E D  
FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C  
PE Title: Theater Missile Defense (U)

Project Number: 2209  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

- o Conduct second and third Arrow lethality test flights using the Arrow I interceptor against a surrogate target carrying simulated chemical submunitions.
- o Complete design of Arrow II interceptor and launcher.
- o Conduct launcher canister tests.
- o Conduct electro-optical seeker survivability tests.
- o Initiate Arrow II interceptor flight tests.

(\$0,000) ACES Support

- o Conduct remaining Arrow II guidance and control and system critical design reviews (CDR).
- o Continue to use Arrow data for risk reduction in the THAAD and SM-2 Block IV A programs.
- o Continue technical and programmatic oversight and management of ACES contract.

(\$5,000) Arrow Deployability Program

- o Negotiate memorandum of agreement (MOA).
- o Provide Presidential certification to Congress.
- o Award contract for Arrow Deployability Program.

(U) FY 1995 Plans:

(\$40,200) Arrow Continuation Experiments (ACES)

- o Complete Arrow II flight tests.
- o Complete interceptor production.
- o Complete flight test performance analyses.

(\$7,200) ACES Support

- o Continue to use Arrow data for risk reduction in the THAAD and SM-2 Block IV A programs.
- o Develop and use high fidelity seeker models to analyze seeker performance.
- o Complete analyses of each Arrow II subsystem to achieve timely development of the Arrow system to include the BMC3 and acquisition and tracking radars.

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U N C L A S S I F I E D

FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C

PE Title: Theater Missile Defense (U)

Project Number: 2209  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

(\$5,000) Arrow Deployability Program

- o Define system interfaces.
- o Initiate hardware procurement for system tests.
- o Initiate deployability and interoperability studies.

(U) Program Plan to Completion: By completing the Arrow Deployability Program, U.S. TMD programs will be afforded state-of-the-art technical data for program risk reduction and the Government of Israel will have developed information to make a sound Arrow system deployment decision.

D. (U) WORK PERFORMED BY:

- o Israel Aircraft Industries - Israel

E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY

- 1. TECHNICAL CHANGES: None
- 2. SCHEDULE CHANGES: Initiation of Arrow I lethality flight tests and Arrow II CDR delayed until FY94.
- 3. COST CHANGES: None

F. (U) PROGRAM DOCUMENTATION:

- o ACES manufacturing/engineering design drawings and various program review documents
- o ACES Memorandum of Agreement

G. (U) RELATED ACTIVITIES:

- o 1502 Lethality and Target Hardening

PE No. 6.3

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C  
PE Title: Theater Missile Defense (U)

Project Number: 2209  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

- 0 2104 GBR
- 0 2207 PATRIOT
- 0 2210 THAAD
- 0 3201 Architecture Studies
- 0 3300 Test and Evaluation Support

- PE No. 6.3/6.4/6.5
- PE No. 6.4/6.5
- PE No. 6.4/6.5
- PE No. 6.3
- PE No. 6.3

There is no unnecessary duplication of effort within BMDO or the DoD.

H. (U) OTHER APPROPRIATION FUNDS: None

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: This is a Joint Program with the Government of Israel; MOU signed 7 June 1991.

- J. (U) MILESTONE SCHEDULE:
- 0 Arrow I flight tests initiated
  - 0 Arrow II CDR
  - 0 Launcher production completed
  - 0 Arrow II flight tests initiated
  - 0 Interceptor production completed
  - 0 Arrow II flight tests completed
  - 0 Contract end

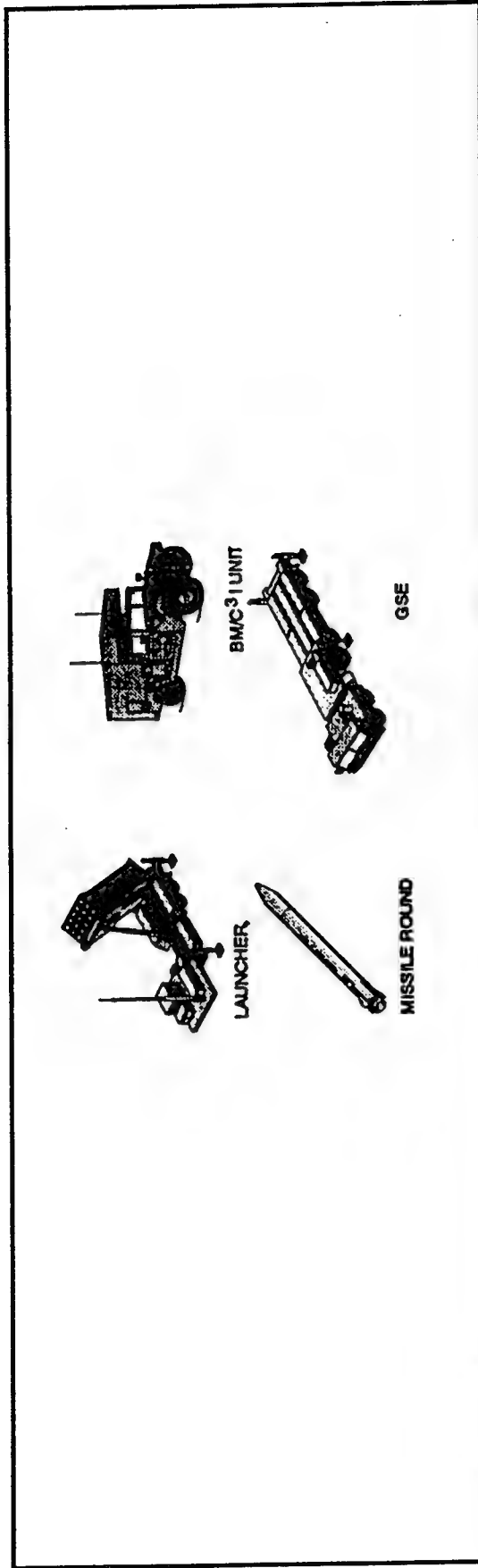
- 2Q/FY93
- 2Q/FY94
- 2Q/FY94
- 4Q/FY94
- 1Q/FY95
- 4Q/FY95
- 4Q/FY95

U N C L A S S I F I E D

## FY 1995 RDT&amp;E DESCRIPTIVE SUMMARY

Program Element: 0604216C/0604225C  
 PE Title: Theater Missile Defense (U)  
 Project Title: THAAD

Project: 2210  
 Budget Activity: 04/05  
 Dem/Val/EMD (U)  
 February 1994



POPULAR NAME: THAAD  
 A. (U) SCHEDULE/BUDGET INFORMATION: (\$ in Thousands)

BUDGET	FY 1993 DEM/VAL	FY 1994 DEM/VAL	FY 1995 DEM/VAL	FY 1996 DEM/VAL	FY 1997 EMD	FY 1998 EMD	FY 1999 EMD	Program Total
Major Contract	223,000	340,948	411,560	374,280	261,650	448,615	403,565	
Support Contract	37,400	28,887	29,260	23,950	60,900	41,200	21,425	
In-House Support	0	12,601	14,559	14,559	15,059	14,559	14,559	
GFE/Other	12,600	52,222	40,311	44,501	65,691	64,526	68,826	
Total	273,000	434,658	495,690	457,290	403,300	568,900	508,375	8,268M

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# U N C L A S S I F I E D

## FY 1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604216C/0604225C  
PE Title: Theater Missile Defense (U)  
Project Title: THAAD

Project: 2210  
Budget Activity: 04/05  
Dem/Val/EMD (U)  
February 1994

SCHEDULE	FY 1993	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	To Complete
Program Milestones			40 Missile Option (UOES)		UOES Missile Delivery Begins			MSII Approval (4Q96)
Engineering Milestones	Init UOES Design Review Complete (2Q)	Final UOES Design Complete (A Specs) Missile FDR (1Q)						
T&E Milestones		BMC3I FDR (3Q) Begin Flight Tests (4Q)	Begin System Tests (4Q)					
Contract Milestones								EMD Contract Award (4Q96)

### B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) The THAAD system is being designed to negate theater ballistic missiles (TBM) at long ranges and high altitudes. Its long-range intercept capability will make possible the protection of broad areas, dispersed assets, and population centers against TBM attacks. High altitude intercepts will allow an effective defense against maneuvering reentry vehicles (MARVs) and greatly reduce the probability that debris and chemical or biological agents from a TBM warhead will reach the ground. The combination of high altitude and long-range intercept capability may also provide multiple engagement (shoot-look-shoot) opportunities. THAAD will be interoperable with both existing and future air defense systems and other external data sources (e.g., space-based sensors). This netted and distributed BM/C<sup>3</sup>I architecture will provide robust protection against the entire TBM spectrum.

(U) The THAAD element includes missiles, launchers, BM/C<sup>3</sup>I units, and support equipment. The Theater Missile Defense Ground-based Radar (TMD-GBR) element will provide fire control and surveillance for THAAD

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U N C L A S S I F I E D

FY 1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604216C/0604225C  
PE Title: Theater Missile Defense (U)  
Project Title: THAAD

Project: 2210  
Budget Activity: 04/05  
Dem/Val/EMD (U)  
February 1994

as well as for other TMD systems. The THAAD element, combined with the TMD-GBR element, forms the THAAD system. The THAAD system will be C-130/C-141 transportable. Furthermore, an engineering analysis for adapting the THAAD system in a cost and operationally effective manner for a sea-based defense is being conducted.

(U) The THAAD demonstration/validation (Dem/Val) program includes an option for building a prototype "battery" called the User Operational Evaluation System (UOES). It will consist of 40 missiles with 4 launchers, 2 BM/C<sup>3</sup> units, 2 TMD-GBRs and support equipment. The UOES will be used primarily for early operational assessment, but will also be available for use during a national emergency. This approach provides near-term improved TMD capability and lowers the risk of subsequent phases of the acquisition cycle. The objective system will be fielded in the 2001 time frame.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

- (U) FY 1993 Accomplishments:
- o Completed a revision of program life-cycle-cost estimate.
  - o Continued Dem/Val and risk management effort for the THAAD system.
  - o Conducted initial design review on 20-21 January 1993.
  - o Demonstrated missile design in wind tunnel tests.
  - o Completed nuclear hardening study.
  - o Conducted booster and shroud separation testing.
  - o Began hardware-in-the-loop (HWIL) testing.

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FY 1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604216C/0604225C  
PE Title: Theater Missile Defense (U)  
Project Title: THAAD

Project: 2210  
Budget Activity: 04/05  
Dem/Val/EMD (U)  
February 1994

- (U) FY 1994 Plans:
- o Continue booster and shroud testing.
  - o Conduct final design review.
  - o Continue HWIL testing.
  - o Continue preparation for missile flight test program.
    - oo Propulsion testing
    - oo Guidance and control testing
  - o Begin launcher and BM/C<sup>3</sup> brassboard testing.
  - o Begin TMD-GBR testbed integration.
  - o Begin missile flight test program.

- (U) FY 1995 Plans:
- o Complete missile flight test program.
  - o Begin THAAD system tests with TMD-GBR and launcher.
  - o Complete system specification review (SSR).
  - o Begin system flight test program.

- (U) Program Plan to Completion: This is a continuing program.

D. (U) WORK PERFORMED BY:

- o Lockheed Missiles and Space Company (Dem/Val) - Sunnyvale, CA

E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

1. TECHNICAL CHANGES: None
2. SCHEDULE CHANGES: A robust Dem/Val flight test program based on refined threat data required an extended flight test preparation period.

U N C L A S S I F I E D

FY 1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604216C/0604225C  
 PE Title: Theater Missile Defense (U)  
 Project Title: THAAD

Project: 2210  
 Budget Activity: 04/05  
 Dem/Val/EMD (U)  
 February 1994

3. COST CHANGES: FY 94 costs adjusted from \$495.8M to \$478.9M due to a revised program life-cycle-cost estimate (PLCCE) dated 20 Aug 93.

F. (U) PROGRAM DOCUMENTATION:

- o Milestone I Defense Acquisition Board documentation in accordance with the new DoDD 5000.1, DoDI 5000.2 and DoD 5000.2-M.

G. (U) RELATED ACTIVITIES:

- o 1501 Survivability PE No. 6.3
- o 1502 Lethality and Target Hardening PE No. 6.3
- o 2104 GBR PE No. 6.3/6.4/6.5
- o 2209 Arrow/ACES PE No. 6.3
- o 3201 Architecture Studies PE No. 6.3
- o 3300 Test and Evaluation Support PE No. 6.3
- o 4100 Program Management PE No. 6.6

There is no unnecessary duplication of effort within BMDO or the DoD.

- H. (U) OTHER APPROPRIATION FUNDS: Procurement FY 1999: \$317.361M

- I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

- J. (U) TEST AND EVALUATION DATA:

- o Flight Test Start
- o System Test Start

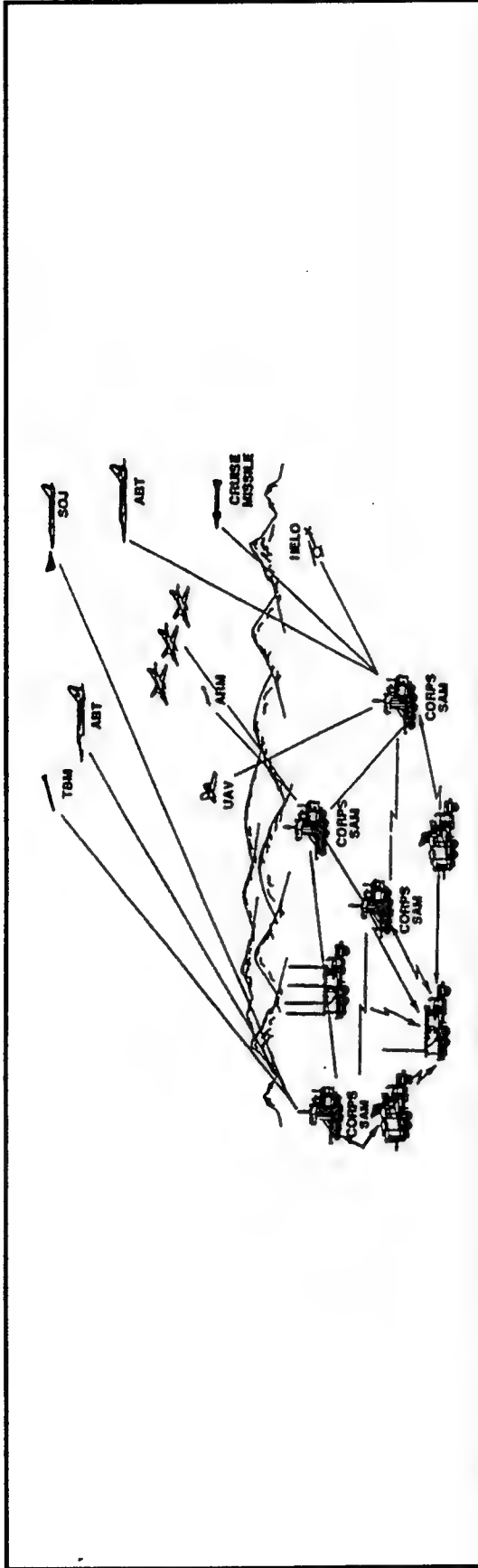
4Q/FY94  
 4Q/FY95

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FY 1995 RDT&E DESCRIPTIVE SUMMARY

Project Number: 2212  
 Budget Activity: 03  
 Adv Tech Dev (U)  
 February 1994

Program Element: 0603216C  
 PE Title: Theater Missile Defense (U)  
 Project Title: CORPS Surface-to-Air Missile



POPULAR NAME: CORPS SAM  
 A. (U) SCHEDULE/BUDGET INFORMATION: (\$ in Thousands)

BUDGET	FY 1993 ATD	FY 1994 ATD	FY 1995 ATD	FY 1996 ATD	FY 1997 ATD	FY 1998 DEM/VAL	FY 1999 DEM/VAL	Program Total
Major Contract	5,000	0	6,440	13,388	TBD	TBD	TBD	
Support Contract	8,400	6,900	3,699	5,782	TBD	TBD	TBD	
In-House Support	7,000	8,100	5,686	8,871	TBD	TBD	TBD	
GFE/Other	1,600	5,000	1,900	2,549	TBD	TBD	TBD	
Total	22,000	20,000	17,725	30,590	33,400	36,510	39,145	15,205M*

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U N C L A S S I F I E D

FY 1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C  
 PE Title: Theater Missile Defense (U)  
 Project Title: CORPS Surface-to-Air Missile

Project Number: 2212  
 Budget Activity: 03  
 Adv Tech Dev (U)  
 February 1994

SCHEDULE	FY 1993	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	To Complete
Program Milestones					MS I REVIEW			
Engineering Milestones				Conduct System Requirements Review	Complete Concept Development			Complt Init. Prototype Hardware *
T&E Milestones								Initiate * Develop Tests
Contract Milestones	Complete Concept Def. Studies	Release Concept Development RFP	Award Concept Development Contract			Award System Development Contract		

\* If selected as the Advanced Capabilities Dem/Val Program under project 2215

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) The CORPS SAM system is a Major Defense Acquisition Program and a key element of the TMD segment of the ballistic missile defense (BMD) architecture that will be deployed and operated by both the Army and Marine Corps. It is the critical lower tier component of the active defense pillar which is required to provide low-to-medium altitude air defense (AD) and theater missile defense (TMD) in the context of the early entry, movement to contact, and decisive operations of Army Operations and the rapid force projection needs of the U.S. national war-fighting strategy. As such, it will protect critical fixed assets in the echelons above corps and corps rear and mobile assets of the maneuver forces located in the expanding forward area of the corps. CORPS SAM will be small, lightweight, and modularly configured in order to be highly transportable and mobile compared to current AD/TMD systems. It will provide 360-degree defense against multiple and simultaneous attacks by a wide variety of tactical missiles and air-breathing threats (ABT) that employ both conventional and unconventional warheads. Specifically, these

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FY 1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C

PE Title: Theater Missile Defense (U)

Project Title: CORPS Surface-to-Air Missile

Project Number: 2212  
Budget Activity: 03  
Adv Tech Dev (U)  
February 1994

threats include short and very short range tactical ballistic missiles as well as cruise missiles, unmanned aerial vehicles, and both fixed and rotary wing aircraft. These offensive and reconnaissance, intelligence, surveillance, and target acquisition (RISTA) threats are primarily targeted against corps assets and operate behind, above, and beyond forward area AD. CORPS SAM will be compatible and interoperable with other Army, Service, and Allied systems expected to participate in joint/combined operations.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1993 Accomplishments:

- o Established system operational requirements.
- o Conducted Cost and Operational Effectiveness Analysis (COEA).
- o Completed contractor and in-house Concept Definition studies.
- o Established a foundation for international cooperation with Germany.

(U) FY 1994 Plans:

- o Release Request For Proposals (RFP) for Concept Development Contract.
- o Continue in-house technical and operational analyses/trades.
- o Develop a Memorandum of Agreement (MOA) for international cooperation with Germany (given a positive German decision).
- o Initiate source selection/evaluation activities.

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## FY 1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C

PE Title: Theater Missile Defense (U)

Project Title: CORPS Surface-to-Air Missile

Project Number: 2212

Budget Activity: 03

Adv Tech Dev (U)

February 1994

### (U) FY 1995 Plans:

0 Competitively award two contracts for Concept Development.

(U) Program Plan to Completion: Down-select to a single prime contractor for execution of system development and obtain Milestone I approval. Execute concept development activities. Conduct system requirements review and baseline system level specification (A-Spec).

### D. (U) WORK PERFORMED BY:

- 0 CORPS SAM Project Management Office - Redstone Arsenal, AL
- 0 U.S. Army Air Defense Artillery School - Fort Bliss, TX
- 0 Contractors to be selected in FY95 for Concept Development

### E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

- 1. TECHNICAL CHANGES: None
- 2. SCHEDULE CHANGES: None
- 3. COST CHANGES: None

### F. (U) PROGRAM DOCUMENTATION:

- 0 Mission Need Statement - August 1990
- 0 Operational Requirements Document - October 1993
- 0 STAR Threat - June 1993
- 0 System Operational Document - August 1991
- 0 Test and Evaluation Master Plan - October 1993

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FY 1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C

PE Title: Theater Missile Defense (U)

Project Title: CORPS Surface-to-Air Missile

Project Number: 2212  
Budget Activity: 03  
Adv Tech Dev (U)  
February 1994

G. (U) RELATED ACTIVITIES:

- o 1502 Lethality and Target Hardening
  - o 3201 Architecture Studies
  - o 3211 C<sup>4</sup>I
  - o 3300 Test and Evaluation Support
- There is no unnecessary duplication of effort within BMDO or the DoD.

PE No. 6.3  
PE No. 6.3  
PE No. 6.3/6.4  
PE No. 6.3

H. (U) OTHER APPROPRIATION FUNDS: None

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None. Significant progress has been made in establishing a foundation for potential cooperation with Germany. A German decision is expected in the January 1994 timeframe.

J. (U) MILESTONE SCHEDULE:

- o Concept definition studies contract award
- o Concept definition studies completed (in-house and industry)
- o Release RFP for concept development
- o Concept development contract award
- o System Requirements Review
- o Milestone I review
- o System development contract award \*
- o Preliminary Design Review \*

3Q/FY92  
2Q/FY93  
3Q/FY94  
2Q/FY95  
3Q/FY96  
4Q/FY97  
1Q/FY98  
1Q/FY99

\* If selected as the Advanced Capabilities Dem/Va1 Program under project 2215

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604216C/0604225C  
PE Title: Theater Missile Defense (U)

Project Number: 2213  
Budget Activity: 04/05  
Dem/Val/EMD (U)  
February 1994

A. (U) RESOURCES: (\$ in Millions)  
Project Title: Sea-Based Area TBMD

Program Name:	FY1993 Actual	FY1994 Estimate	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	Total Program
0208060C PROC	0	0	14,496	11,287	49,265	150,225	143,392	4,847M
0603216C RDT&E	5,500	0	0	0	0	0	0	
0604216C RDT&E	59,100	154,000	179,543	240,224	242,308	4,328	6,322	
0604225C RDT&E	0	0	0	0	0	137,760	104,390	

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) The theater ballistic missile (TBM) threat is present and growing in terms of both weapon proliferation and sophistication. Sea-based assets can provide a significant contribution to theater ballistic missile defense (TBMD) objectives. Development of a sea-based theater ballistic missile defense capability takes advantage of the attributes of naval forces including overseas presence, mobility, flexibility, and sustainability in order to provide protection to debarkation ports, coastal airfields, amphibious objective areas, Allied forces ashore, population centers, and other high value sites. Additionally, in many cases, sea-based assets will provide the only means to establish an initial TBM defense for the insertion of additional land-based TBMD assets and other expeditionary forces in an opposed environment. The sea-based area TBMD project builds on the \$428 national investment in AEGIS ships, weapon systems, and missiles. Two classes of ships continue to be deployed with the AEGIS combat system: the CG-47 Ticonderoga-class cruisers and the DDG-51 Burke-class destroyers. The Secretary of Defense's Bottom-Up Review (BUR) in FY 94 established Sea-Based Area TBMD as one of the core major acquisition programs for Theater Missile Defense. Project costs and schedule reflect this priority. The sea-based project is dependent upon receipt of the requested funding. Navy theater air defense (TAD) programs were consolidated under a new Program Executive Officer (PEO) organization to include TBMD,

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604216C/0604225C  
PE Title: Theater Missile Defense (U)

Project Number: 2213  
Budget Activity: 04/05  
Dem/Va1/EMD (U)  
February 1994

cooperative engagement capability (CEC), ship self defense, and battle management/command, control, and communications (BM/C3).

- (U) Attributes of a Sea-based Area TBMD capability supported by the requested funding include:
  - o Modifications to the AEGIS combat system (ACS) to include software modifications to the command and decision system, the AEGIS display system, and the radar system (AN/SPY-1B/D).
  - o Modifications to the Navy Standard Missile (SM-2 Block IV) and the AEGIS weapon control system with a Standard Missile (SM-2 Block IV A) in FY 1999 capable of engaging TBMs in the endoatmosphere.\*
  - o A goal of fielding a user operational evaluation system (UOES) consisting of the SM-2 Block IV A and selected, limited non-tactical ACS modifications in FY 1997 if required to counter an existing threat.
- \* First unit equipped (FUE) is scheduled for FY 1999.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

- (U) FY 1993 Accomplishments:
  - o Issued Sea-based TBMD Mission Need Statement (MNS) and AEGIS/SM-2 Block IV A Operational Requirements Document (ORD).
  - o Associated Navy upper tier activities (Milestone 0 with its supporting Cost and Operational Effectiveness Assessment (COEA), THAAD interfacing effort, and Standard Missile/LEAP technology demonstration) with project number 1210, and Marine Corps TBMD activity with project number 2308.
  - o Completed concept evaluation leading to the definition of the Sea-Based Area TBMD program.
  - o Commenced design and evaluation of necessary ACS modifications.

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## FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604216C/0604225C

PE Title: Theater Missile Defense (U)

Project Number: 2213

Budget Activity: 04/05

Dem/Va1/EMD (U)

February 1994

- o Delivered preliminary SPY radar tracking computer program modifications to support ballistic missile tracking data collection at sea.
  - o Conducted successful AEGIS tracking experiments in conjunction with TMD Countermeasures Mitigation Program using proof-of-principle special computer program package.
  - o Conducted critical at-sea tracking experiment using the SPY radar and AEGIS weapon system, with preliminary modifications, to obtain data required for a better understanding of system TBMD capabilities and necessary modifications.
  - o Identified effort to demonstrate PATRIOT acceptance of SPY radar data.
  - o Participated in a variety of important analyses and engineering activities pertaining to cueing and tracking experiments.
  - o Completed concept definition of SM-2 Block IV modifications required to provide TBM interceptor capability. Initiated risk mitigation efforts.
  - o Demonstrated developmental computer programs to detect and track TBM at extremely long range (almost twice the instrumented range of the radar).
- (U) FY 1994 Plans:
- o Continue design of ACS modifications.
  - o Continue development/design of SM-2 Block IV modifications to provide for capability to intercept TBMs. Continue risk mitigation efforts and flight test round development.
  - o Demonstrate AEGIS cueing to PATRIOT system in consonance with the JADO/JEZ event. Develop a plan to demonstrate PATRIOT acceptance of remote SPY TBM track data.
  - o Initiate a request for proposal (RFP) for tactical AEGIS combat system modifications.
  - o Develop subsystems to the SM-2 Block IV A to support risk reduction flight tests in FY 95.
  - o Continue computer program development to accept stereo DSP and cue AEGIS to increase track acquisition range against a TBM.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604216C/0604225C

PE Title: Theater Missile Defense (U)

Project Number: 2213  
Budget Activity: 04/05  
Dem/Val/EMD (U)  
February 1994

(U) FY 1995 Plans:

- o Complete design of initial ACS computer program modifications to enable TBMD detection, tracking and weapon processing to support an SM-2 missile with TBMD capability.
- o Conduct land-based and at-sea experiments to demonstrate acceptance of long-range (off ship) cueing and SPY radar acquisition.
- o Initiate design and integration for SM-2 Block IV A missile engineering and manufacturing development (EMD).
- o Initiate procurement of developmental SM-2 Block IV A missiles to support an FY 97 UOES and planned flight tests.
- o Award contract for tactical AEGIS combat system modifications.
- o Commence risk reduction flight tests at White Sands Missile Range (WSMR) to resolve issues of thermal blur, IR seeker performance, IR cover survivability and model validation.

- (U) Program Plan to Completion: If funding is provided at the levels requested, this effort will continue so as to provide the UOES of an SM-2 TBMD interceptor variant (SM-2 Block IV A) and necessary AEGIS combat system limited, non-tactical modifications for 1 ship and 35 missiles by FY 1997. First unit equipped (FUE) is scheduled for FY 1999 and will consist of a fully integrated AEGIS combat system capable of performing the TBMD mission simultaneously with existing AEGIS ship missions (ASW, ASUW, Strike, and AAW).

D. WORK PERFORMED BY:

(U) In House:

- o Navy Program Executive Office for Theater Air Defense - Crystal City, VA
- o Naval Surface Warfare Center - Dahlgren, VA
- o Naval Air Warfare Center - China Lake, CA
- o Naval Command and Control Oceanographic Systems Center

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604216C/0604225C  
PE Title: Theater Missile Defense (U)

Project Number: 2213  
Budget Activity: 04/05  
Dem/Val/EMD (U)  
February 1994

(U) Major Contractors:  
o Martin-Marietta  
o Raytheon  
o Hughes

E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

1. TECHNICAL CHANGES: This project title was formerly "Naval and Marine Corps TMD." Marine Corps TMD is now carried under project number 2308.
2. SCHEDULE CHANGES: None
3. COST CHANGES: The projected program costs are more accurately defined and estimated.

F. (U) PROGRAM DOCUMENTATION:

o	AEGIS/SPY and SM-2 Block IV ORDs	1Q/FY93
o	Sea-based TBMD MNS	2Q/FY93
o	Cost Analysis Requirements Document	1Q/FY94
o	Draft Acquisition Strategy Report	4Q/FY94
o	Draft Integrated Program Summary	4Q/FY94
o	Draft Test and Evaluation Master Plan	4Q/FY94

G. (U) RELATED ACTIVITIES:

o	1105 Discrimination	PE No. 6.3
o	1106 Sensor Studies and Experiments	PE No. 6.3
o	1202 Interceptor Integration Technology	PE No. 6.3
o	1216 Sea-Based Wide Area Technology	PE No. 6.3
o	1501 Survivability	PE No. 6.3

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## FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604216C/0604225C

PE Title: Theater Missile Defense (U)

Project Number: 2213  
Budget Activity: 04/05  
Dem/Va1/EMD (U)  
February 1994

PE No. 6.3  
PE No. 6.3/6.4/6.5  
PE No. 6.4/6.5  
PE No. 6.3  
PE No. 6.4/6.5  
PE No. 6.3/6.4/6.5  
PE No. 6.3  
PE No. 6.3  
PE No. 6.3

- o 1502 Lethality and Target Hardening
- o 2104 Ground-based Radar
- o 2207 PATRIOT
- o 2209 ACES
- o 2210 THAAD
- o 2212 Corps SAM
- o 3201 Architecture Studies
- o 3203 Intelligence Threat
- o 3300 Test and Evaluation Support

There is no unnecessary duplication of effort within BMDO or the DoD.

### H. (U) OTHER APPROPRIATION FUNDS:

- o Procurement: FY 1995 \$14.496M; FY 1996 \$11.287M; FY 1997 \$49.265M; FY 1998 \$150.225M; FY 1999 \$143.392M
- o C1120 Air Defense Missile Systems Project

### I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

### J. (U) MILESTONE SCHEDULE:

- o Program review (sea-based area TBMD)
  - o ACS tactical system RFP
  - o AEGIS combat system modifications contract award
  - o AEGIS cueing and control experiment
  - o DAB Milestone IV/II review
  - o ACS ADM capability
  - o SM-2 BLK IV A land-based flight tests at WSMR
- 2Q/FY94  
4Q/FY94  
2Q/FY95  
3Q/FY95  
1Q/FY96  
2Q/FY96  
3Q/FY96

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604216C/0604225C

PE Title: Theater Missile Defense (U)

Project Number: 2213  
Budget Activity: 04/05  
Dem/Val/EMD (U)  
February 1994

0	SM-2 BLK IV A development flight tests at sea	3Q/FY97
0	SM-2 BLK IV A operational flight tests	4Q/FY97
0	ACS and SM-2 Block IV A UOES (1 ship/35 missiles)	FY1997
0	ACS Mod/SM-2 BLK IV A FUE	FY1999

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FY 1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604216C

PE Title: Theater Missile Defense (U)

Project Title: Advanced Capabilities DEM/VAL Program

Project Number: 2215

Budget Activity: 04

Dem/Val(U)

February 1994

T O B E D E T E R M I N E D

POPULAR NAME: Advanced Capabilities DEM/VAL Program

A. (U) SCHEDULE/BUDGET INFORMATION: (\$ in Thousands)

BUDGET	FY 1993	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998 DEM/VAL	FY 1999 DEM/VAL	Program Total
Major Contract						TBD	TBD	
Support Contract						TBD	TBD	
In-House Support						TBD	TBD	
GFE/Other						TBD	TBD	
Total						164,690	260,980	TBD

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FY 1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604216C  
 PE Title: Theater Missile Defense (U)  
 Project Title: Advanced Capabilities DEM/VAL Program

Project Number: 2215  
 Budget Activity: 04  
 Dem/Val(U)  
 February 1994

SCHEDULE	FY 1993	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	To Complete
Program Milestones						MS I DECISION		
Engineering Milestones								
T&E Milestones								
Contract Milestones								

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) This project funds the Advanced Capabilities DEM/VAL Program. In FY 1998, a MS I DAB decision will determine which Advanced Capabilities program (Corps SAM, Sea Based Wide Area, Boost Phase Intercept/Exo-Interceptor) will enter the Demonstration and Validation (DEM/VAL) phase of the acquisition process. DEM/VAL is expected to last from four to six years before a decision is made regarding Engineering and Manufacturing Development.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

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FY 1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604216C  
PE Title: Theater Missile Defense (U)  
Project Title: Advanced Capabilities DEM/VAL Program

Project Number: 2215  
Budget Activity: 04  
Dem/Val(U)  
February 1994

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1993 Accomplishments: None.

(U) FY 1994 Plans: None.

(U) FY 1995 Plans: None.

(U) Program Plan to Completion: This is a continuing program.

D. (U) WORK PERFORMED BY: TBD

E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

1. TECHNICAL CHANGES: Not applicable.
2. SCHEDULE CHANGES: Not applicable.
3. COST CHANGES: Not applicable.

F. (U) PROGRAM DOCUMENTATION: None.

G. (U) RELATED ACTIVITIES:

- o Concept studies for Corps SAM (Project 2212), Sea Based Wide Area (Project 1216), Boost Phase Intercept/Exo Interceptor (Project 1215) leading to a milestone decision.
- o There is no unnecessary duplication of effort within BMD0 or the DoD.

H. (U) OTHER APPROPRIATION FUNDS: TBD.

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FY 1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604216C

PE Title: Theater Missile Defense (U)

Project Title: Advanced Capabilities DEM/VAL Program

Project Number: 2215  
Budget Activity: 04

Dem/Val(U)  
February 1994

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: TBD.

J. (U) MILESTONE SCHEDULE:

o MS I DAB Decision

FY98

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 2300  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

A. (U) RESOURCES: (\$ in Thousands)  
Project Title: BM/C3 Technology

Program Name:	FY1993 Actual	FY1994 Estimate	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	Total Program Continuing
0603216C RDT&E	0	130	0	0	0	0	0	0
0603217C RDT&E	49,048	23,197	56,500	59,000	59,000	59,000	59,000	59,000

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENTS AND SYSTEM CAPABILITIES:

(U) In FY93 the BMC3 Program was in an acquisition mode, having recently transitioned from a technology program and was funded accordingly through FY93. As a result of the OSD Bottoms-Up-Review (BUR) presented fourth quarter FY93 the FY94 BMC3 Program focus changed from acquisition of the Command and Control Element (C2E) to BMC3 technology readiness and the funding was reduced by 47 percent. FY94 reflects a transition from acquisition to development of technologies to support rapid contingency BMD deployments for national BMD against evolving/emerging threats.

(U) The BMC3 Program will develop BMC3 technologies to support system integration and increasingly capable rapid-prototyping and contingency deployment options. The objectives of this technology program are: (1) to coordinate with the BMD Operator/User, "Warfighter" organizations to clarify and capture operational requirements in a structured BMD BMC3 Information Architecture as an integral first step to support a BMD BMC3 technology readiness program; and, (2) to participate in the demonstration, exercise and test of BMD weapon, BMD sensor and BMD-supporting sensor technologies and systems to provide an operational context for technology readiness (BMC3, weapon and sensor) assessment, evaluation and planning. This technology program will leverage and grow from existing communications, command and control and processing capabilities.

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## FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 2300

Budget Activity: 03

Adv Technology Dev (U)

February 1994

(U) The BMC3 technology program will concentrate on definition, development and implementation of the BMC3 Information Architecture; object-oriented analysis, object-oriented design and object-oriented programming (OOA-OOD-OOP); and, software reuse and independent verification and validations (IV&V). These key program dimensions support an Evolutionary Development approach for BMC3 and maintain a limited BMC3 capability to support near-term BMD deployment options.

(U) Command and Control (C2) technology efforts will emphasize human-in-control (HIC) decision support processes that enable USCINCSpace/CINCNORAD to select and command system control directives required to operate and maintain assured control over the national BMD system and support TMD operations. Engagement Planning (EP) technologies will emphasize automated processor response to C2 directives; sensor data fusion; communications, sensor and weapon task plan development; and, provision of real-time summary data to assess system/mission performance. Emphasis in communications technology development will be on network management; information and communications security; and external systems interfaces.

(U) During FY93 both CDS 2300 and 2307 were funded from dollars allocated to CDS 2300.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

### C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

#### (U) FY 1993 Accomplishments:

- o (\$8,000K) Awarded and managed Options Assessment Contracts (3).
- o (\$250K) Published Program Documentation (CARD, C2E Program Plan).
- o (\$3,000K) Developed initial BMC3 Information Architecture.
- o (\$750K) Developed IV&V Strategy and initiated the IV&V Program.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C  
 PE Title: Ballistic Missile Defense (U)

Project Number: 2300  
 Budget Activity: 03  
 Adv Technology Dev (U)  
 February 1994

- o (\$31,798K) Prototyped, integrated and demonstrated initial Block 0 functionality at the National Test Facility (NTF). Used prototyped capabilities to support System Integrated Test (SIT) IV.
- o (\$1,500K) Conducted C2 Theater Exploitation Demonstrations (TED).
- o (\$250K) Developed and revised C2E Sub-Element Program Plans Drafts.
- o (\$3,500K) Conducted C2E Systems Engineering.

(U) FY 1994 Plans:

- o (\$8,500K) Complete Options Assessment Contracts.
- o (\$1,500K) Prepare Acquisition Package for System Engineering Integration/BMC3 DEMVAL contract for (functional) development.
- o (\$3,000K) Prototype and refine BMC3 Information Architecture.
- o (\$7,000K) Conduct BMC3 Block 0 Enhancement, Integration and User Demonstrations to establish traceability to the evolving BMC3 Information Architecture.
- o (\$1,000K) Initiate effort to demonstrate EWR role in BMD in coordination with the UK.
- o (\$2,167K) Support Technology Readiness Program and TMD demonstrations, tests and exercises.
- o (\$30K) MILCON

(U) FY 1995 Plans:

- o (\$2,000K) Evolve BMC3 Information Architecture and Systems Engineering in coordination with User/Operator and Supporting C4I organizations. Support development of BMD Information Architecture.
- o (\$20,000K) Enhance BMC3 Block 0 functional capabilities and insert BMC3 technologies in coordination with BMC3 Information Architecture and User Demonstration plans. Support evolution of operational requirements and CONOPs in support of evolving EPOCH 1 BMC3 contingency capabilities, and in support of evolutionary BMC3 development (BMC3 Block 1).
- o (\$4,500K) Demonstrate EWR role in BMD. Integrate and validate software modifications to support this role. Develop contingency plans for the role of EWR in BMD.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 2300  
Budget Activity: 03  
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- o (\$25,000K) Award and manage Systems Engineering Integration/BMC3 DEMVAL contract for (functional) BMC3 Block 1 development.
- o (\$5,000K) Support Technology Readiness Program EPOCH 1 and TMD demonstrations & tests. Develop plans, reports and measures of evaluation/assessment/performance. Incorporate and exercise BMC3 Block 0 and UEMR in planned activities. Implement communications support as required.

(U) Program Plan to Completion:

(U) This program uses an evolutionary development strategy. BMC3 technology capabilities will be developed to support epochs of the BMD Advanced Technology Program. Specifically, BMC3 capabilities will be enhanced and expanded to support evolutionary technology developments in sensor and weapon systems. BMC3 Build 1 capability is programmed in first quarter FY 1998, BMC3 Build 2 capability in first quarter FY 2001, BMC3 Build 3 in first quarter FY 2004. BMC3 Information Architecture, OOA-00D-00P and evolutionary development efforts will be maintained to support deployment options.

D. (U) WORK PERFORMED BY:

- o System Engineering and Integration Contractor (Martin Marietta); Blue Bell, PA; Arlington, VA; Huntsville, AL; Boston, MA
- o US Army PEO Missile Defense ROC/COMM Project Office; Huntsville, AL
- o US Air Force Electronic Systems Center; Hanscom AFB, MA
- o US Air Force Space and Missile Systems Center; Los Angeles AFB, CA
- o US Navy Research Laboratory; Washington, DC
- o Department of Energy (National Laboratories); Los Alamos, NM; Argonne, IL; Livermore, CA
- o National Test Facility; Falcon AFB, CO
- o Systems Engineering, Analysis and Technical Support (SETA) Contractors (BDM Federal, TASC, RRI); Arlington, VA

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E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

1. (U) TECHNICAL CHANGES: Significant reductions in C2E Engineering, Test and Evaluation and Supportability will occur as a result of the shift away from an acquisition program. Development of C2E communications, engagement planning and command and control functionality will be reduced, retaining Block 0 enhancements in support of the Technology Readiness Program.

2. (U) SCHEDULE CHANGES:

- C2E Block 1B at NTB, 4QFY97 (canceled)
- BMC3 Validation Experiment, 3QFY98 (canceled)
- Milestone II, 4QFY98 (canceled)
- C2E Block 2 at NTB, 4QFY00 (canceled)
- Milestone III, 4QFY02 (canceled)
- BMD Cell and BMDOC CMAFB installation (canceled)

3. (U) COST CHANGES: The OSD Bottoms-Up-Review (BUR) reoriented and reprioritized the BMD0 program resulting in significant BMC3 Program funding and schedule revisions, and priorities. Effectively the BMC3 program transitioned from an acquisition program to a technology readiness program. The Ground Entry Point (GEP) contract award has been indefinitely deferred. The evolutionary development of BMC3 technologies remains largely unchanged, however acquisition-like activities such as supportability, MILCON and OT&E have also been indefinitely deferred. Exceptions are associated with unique requirement driven by BMC3 technologies. Specifically, this will include development and coordination of innovative, non-DOD standard software supportability concepts to accommodate the lower-cost, compressed development schedule methodology adopted by this program that leverages off "best-commercial-practices." The acquisition milestones schedule is no longer applicable (see para. J for new milestones).

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### F. (U) PROGRAM DOCUMENTATION:

o	USSPACECOM GPALS System/BMC3 Operational Requirements Document (ORD)	12/92
o	USSPACECOM GPALS Concept of Operations (CONOPS) (Draft)	03/92
o	Joint NORAD/USSPACECOM Ballistic Missile Defense Concept of Operations (CONOPS)	06/93
o	BMD System Requirements Document (SRD)	07/93
o	BMC3 Concept Overview	10/92
o	BMC3 Concept Description	10/92
o	C2E CARD (Revised)	05/93
o	C2E Program Plan (Draft)	03/93
o	Communications Sub-Element Program Plan (Draft)	06/93
o	C2 Sub-Element Program Plan (Draft)	08/93
o	EP Sub-Element Program Plan (Draft)	09/93
o	BMC3 Information Architecture (Version 1.0)	03/93

### G. (U) RELATED ACTIVITIES:

o 3101 Engineering / Integration Support PE No. 0603217C  
There is no unnecessary duplication of effort within BMD0 or the DoD.

### H. (U) OTHER APPROPRIATION FUNDS: NONE

### I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

### J. (U) MILESTONE SCHEDULE:

o	BMC3 Block 0	1Q/FY95
o	BMC3 Block 1	1Q/FY98
o	BMC3 Block 2	1Q/FY01
o	BMC3 Block 3	1Q/FY04

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Program Element: 0604216C

PE Title: Theater Missile Defense (U)

Project Number: 2308  
Budget Activity: 04  
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A. (U) RESOURCES: (\$ in Millions)  
Project Title: HAWK System BM/C3

	FY1993	FY1994	FY1995	FY1996	FY1997	FY1998	FY1999	Total
Program Name:	Actual	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Program
0208060C PROC	0	0	3,831	5,131	20,530	0	0	Completed
0604216C RDT&E	0	29,629	26,800	23,000	0	0	0	Completed

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) This project will provide a basic tactical missile defense (TMD) capability for the Marine Corps to provide for a point defense of vital assets in the amphibious operating area of mature and contingency theaters. This TMD capability will be accomplished through product improvements to the AN/TPS-59 radar and the HAWK missile system. Additionally, the development of the Air Defense Communications Platform (ADCP) is included in this project. This project was not affected by the Bottom Up review (BUR)

(U) The AN/TPS-59 modifications include adding a ballistic missile detection and tracking capability, increasing the detection probability on low radar cross section (RCS) targets, and improving the overall system reliability and transportability.

(U) The ADCP development provides the communications capability required to provide AN/TPS-59 cueing data to the HAWK system and to other interceptor systems via the Joint Tactical Information Distribution System (JTIDS).

(U) The HAWK upgrades include processing changes to allow for remote cueing from theater sensors and software changes to perform ballistic missile engagements.

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(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1993 Accomplishments:

- o Conducted AN/TPS-59 system design review (SDR).
- o Began AN/TPS-59 hardware fabrication and software coding efforts.
- o Awarded HAWK TMD modification contract to Raytheon.
- o Awarded ADCP TMD software contract to Advanced Programming Concepts.
- o Held ADCP Milestone I review.

(U) FY 1994 Plans:

- o Conduct AN/TPS-59 design reviews.
- o Begin AN/TPS-59 system integration effort.
- o Conduct ADCP design reviews.
- o Conduct HAWK engineering change proposal (ECP) test readiness review.
- o Conduct HAWK ECP operational testing.
- o Conduct ADCP test readiness review.

(U) FY 1995 Plans:

- o Complete AN/TPS-59 system integration effort.
- o Initiate AN/TPS-59 contractor's developmental tests.
- o Conduct ADCP integration and testing.
- o Approve HAWK ECP for production.

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- (U) Program Plan to Completion:
- o Complete AN/TPS-59 and ADCP operational testing during FY 96.
- o Conduct Milestone III reviews for AN/TPS-59 and ADCP in FY 96.

D. (U) WORK PERFORMED BY:

- (U) In House:
- o Marine Corps Systems Command - Quantico, VA
- o U.S. Army Missile Command - Redstone Arsenal, AL
- o Naval Surface Warfare Center - Crane, IN

- (U) Major Contractors:
- o Raytheon - Bedford, MA
- o Martin-Marietta - Syracuse, NY
- o Sensis - Syracuse, NY
- o Advanced Programming Concepts - San Antonio, TX

E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

- 1. TECHNICAL CHANGES: This program was part of 2106 and 2213 in FY94.
- 2. SCHEDULE CHANGES: This program was part of 2106 and 2213 in FY94.
- 3. COST CHANGES: This program was part of 2106 and 2213 in FY94.

F. (U) PROGRAM DOCUMENTATION:

- o BMDO GPMD
- o AN/TPS-59 Acquisition Decision Memorandum (ADM)

4Q/1993  
3Q/1992

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0	AN/TPS-59 Mission Needs Statement (MNS)	3Q/1992
0	ADCP MNS	3Q/1992
0	HAWK MNS	3Q/1992
0	AN/TPS-59 Operational Requirements Document (ORD)	3Q/1994
0	ADCP ORD	1Q/1994
0	HAWK ORD	1Q/1994
0	AN/TPS-59 Acquisition Program Baseline Agreement (APBA)	4Q/1994
0	ADCP APBA	2Q/1994
0	HAWK APBA	1Q/1994

G. (U) RELATED ACTIVITIES:

0	1215 Ascent/Boost Phase Technology	PE No. 6.3
0	2207 PATRIOT	PE No. 6.4/6.5
0	2213 Sea-based Area TBMD	PE No. 6.4/6.5
0	3300 Test and Evaluation Support	PE No. 6.3

There is no unnecessary duplication of effort within BMDO or the DoD.

H. (U) OTHER APPROPRIATION FUNDS:

0	Procurement: FY1995 \$3.83M; FY 1996 \$5.131M; FY 1997 \$20.530M
0	C1067 Aviation Radar Product Improvement
0	C1120 Air Defense Missile Systems Project

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

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### J. (U) MILESTONE SCHEDULE:

0	AN/TPS-59 preliminary design review (PDR)	2Q/FY94
0	AN/TPS-59 critical design review (CDR)	4Q/FY94
0	AN/TPS-59 operational testing	2Q/FY96 - 3Q/FY96
0	AN/TPS-59 Milestone III review	4Q/FY96
0	ADCP PDR	2Q/FY94
0	ADCP CDR	3Q/FY94
0	ADCP Milestone II decision	1Q/FY96
0	ADCP operational testing	2Q/FY96 - 3Q/FY96
0	ADCP Milestone IIIA	1Q/FY96
0	ADCP Milestone IIIB	4Q/FY96
0	HAWK ECP operational evaluation	2Q/FY94
0	HAWK ECP approval	4Q/FY94

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PE Title: Theater Missile Defense / Ballistic Missile Defense (U)

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A. (U) RESOURCES: (\$ in Thousands)  
Project Title: Engineering/Integration Support

Program Name:	FY1993	FY1994	FY1995	FY1996	FY1997	FY1998	FY1999	Total
	Actual	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Program
0603216C RDT&E	0	12,500	45,590	45,590	45,590	45,590	45,590	Continuing
0603217C RDT&E	137,352	29,105	18,977	18,977	18,977	18,977	18,977	Continuing

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) Provides system engineering, integration and technical management of the Ballistic Missile Defense (BMD) program, including Theater Missile Defense (TMD) and National Missile Defense Technology Readiness Program (NMD/TRP) segments. This Congressional Descriptive Summary is a consolidation of the following FY94 System Engineering and Integration support projects: 2304, 3102, 3103, 3104, 3105, 3108, 3109, 3110, 3111, 3112, 3115, and 4201. These projects constitute the core BMD Systems Engineering program. In prior years, many of these individual projects were executed via separate contracts. As a result of the Secretary of Defense's Bottom-Up Review (BUR) in FY94, funding for the Systems Engineering and Integration activities were reduced to approximately 30% of the FY93 level; FY94 represents a transition year to a focus on TMD. FY95 represents a planned ramp-up from FY94; FY95 activities are 50% of the FY93 baseline level. The FY95 effort is consolidated under work performed through the Systems Engineering and Integration Contract (SEIC). Programs include: mission/threat/performance analysis, simulation and modeling, logistics supportability and producibility, and specialty engineering products to ensure overall system effectiveness, survivability, compatibility and interoperability. In addition, the effort coordinates development of cost-effective, mission-critical software; identifies and develops critical measurement standards, unique to BMD requirements, which provide the scientific basis for measurement of BMD system performance parameters; integrates logistics support, to ensure operational readiness of BMD weapons systems; defines life-cycle costs, schedule and performance risks; identifies critical

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technologies to enhance system performance in order to mitigate future threats; and identifies and tracks critical producibility and manufacturing (P&M) issues and risks. This effort is also responsible for: monitoring the U.S. industrial base capability and develops mitigation strategies for P&M issues, as well as an overall BMDO P&M strategy; development and application of the Surveillance Test Bed (STB), which provides a digital, multi-sensor simulation, inter-Service data fusion capability. Develop and integrates Human-In-Control (HIC) command and control simulations (C2 Sims) for the unified and specified commands and their components. These simulations provide critically needed capability to refine and validate TMD and NMD/TRP operational requirements and concepts of operations (CONOPS). This aids the evaluation of alternative command and control architectures and related information architectures to the requirements allocation process.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

C. PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1993 Accomplishments:

- (7,029) System Software Engineering:
  - o Performed software development evaluations of Ground Based Radar (GBR), Ground Based Interceptor (GBI), Theater High Altitude Air Defense (THAAD), Command Control Element (C<sup>2</sup>E), and National Test Bed (NTB) programs.
  - o Continued development of the Software Engineering Support Environment (SEE).
  - o Updated BMDO, USASSDC, and USAF/SMC Computer Resources Life Cycle Management Plans (CRLCMPs) and Annexes.

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- o Supported US Army and USAF Computer Resources Working Group (CRWG) meetings and software engineering activities.
- (75,057) Systems Engineering and Integration (SE&I):
  - o Completed the System Requirements Document, which established a preliminary engineering and command, control, communications, and intelligence (C3I) baseline for TMD and NMD/TRP missions.
  - o Provided extensive analytical support in submitting options in preparation for, and in response to, the BUR.
  - o Implementation of appropriate BMD technical directives.
  - o Participated in System and Element Program Design Reviews.
  - o Initiated a comprehensive technical and cost risk management program.
  - o Provided funding for follow on SEI/BMC3 Options Assessment contracts.
  - o Provided extensive on call technical analysis for all aspects of the BMD program.
  - o Provided technical lead through the SEIC for 10 other projects funded separately.
  - o SEIC provided on site technical integration assistance to services.
- (2,350) BMD Metrology:
  - o Completed 60 GHz standards for high power, impedance and attenuation; upgrade of automated angle measurement capability to 0.1 micro radian accuracy over full 360 degrees; and design and fabrication of low background infrared (LBIR) spectral instrument.
- (2,918) Integrated Logistic Support:
  - o Updated BMD Integrated Logistics Support Planning and documentation.
- (8,911) Producibility and Manufacturing:

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- o Developed detailed projects for TMD elements to be accomplished by BMDO Manufacturing Operations Development and Integration Laboratories (MODILS). This includes demonstration of improvements in precision optical grinding of SiC mirrors (flat) and in post polishing techniques.
- (41,087) Specialty Engineering Support:
  - o Deliver Test bed improved DEBRA (Debris Radiance) code (Ver 1.1).
  - o Continued integration and design of the Multi-Chip Module (MCM) cryptographic device called WINDJAMMER and began strategy for development and procurement of an Electronic Key Management System (EKMS).
  - o Assess system readiness with respect to emerging engineering requirements, technology, and threat development.
  - o Used Surveillance Test Bed (STB) to validate system simulations using live test data.
  - o Conducted bi-monthly Concept of Operations (CONOPS) Exercises (CONEXs) and bi-annual Command and Control (C2) Sims in direct support of theater CINCs and CINCSpace and the National Test Facility (NTF).
  - o Supported Senior Management in identifying integration issues and performed in-depth analyses of BMD milestones.
  - o Supported the services in their development of the system engineering requirements for the BMD system.
- (U) FY 1994 Plans:
  - (214) System Software Engineering:
    - o Update and release software documents (Policy, Standards, Trusted Software Development Methodology (TSDM) and CRLCMP).
  - (31,000) Systems Engineering and Integration (SE&I):
    - o Update TMD System Requirements Documents and integrate service managed weapon systems via roadmap and Systems Maturity Matrix.

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- o Integrate BMC3 Information Architecture (IA) into technical requirements definition process.
- o Integrate selected NMD/TRP technology readiness options via development roadmap and System Maturity Matrix.
- o Begin NMD/TRP contingency development and deployment planning.
- o Support Weapon System and Element Program Offices in implementing all system engineering policies and standards.
- o Reconcile user Operational Requirements Documents (ORDs) with USSPACECOM and Service proponents.
- o Develop plan and requirements for NMD/TRP System Simulation at NTF.
- o SEIC provide on-site technical integration assistance to services.
- o Provide extensive on call technical analysis for all aspects of the BMD program.

### • (309) BMD Metrology:

- o Continued fabrication of LBIR facility to provide national standards (black body) for Infra-red and optics measurements supporting ARGUS-MSTI, KHILS, Phillips and Lawrence Livermore National Labs and Arnold Development Center. Provides sensor/detector standards to contractors developing focal arrays on the BMD program.

### • (123) Integrated Logistics Support:

- o Update BMD Integrated Logistics Support Planning and documentation.

### • (107) Producibility and Manufacturing:

- o Monitor P&M programs and milestones of TMD and NMD/TRP programs.

### • (9,852) Specialty Engineering Support:

- o Maintain the Surveillance Test Bed and UK data fusion efforts for future TMD and NMD TRP applications.
- o Develop and provide command and control simulations at NTB.

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- o Identify and assist in resolution of system level engineering integration issues for senior leadership.
- o Provide the Services system engineering and integration support for their BMD engineering design and development requirements.

(U) FY 1995 Plans:

- (710) System Software Engineering:
  - o Monitor and assess software development programs.
- (33,600) Systems Engineering and Integration (SE&I):
  - o Continue technology assessments for NMD/TRP; document requirements using Contingency Assessment Notebook.
  - o Develop coordinated technology program to link TMD, NMD and Advanced Concepts programs.
  - o Mature NMD/TRP contingency development and deployment plan.
  - o Use System Maturity Matrix to track TMD interoperability and NMD/TRP maturity against USSPACECOM requirements.
  - o Mature/update System Requirements Documents.
  - o Continue development and implementation of system-level engineering plans, programs, and policies.
  - o Develop NMD/TRP system simulation implementing plan and requirements developed in FY94.
  - o Integrate IA into system design process.
  - o SEIC provide on site technical integration assistance to services.
  - o Provide extensive on call technical analysis for all aspects of the BMD program.
  - o Update TMD System Requirements Documents and integrate service managed weapon systems via roadmap and Systems Maturity Matrix.

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- (1,500) BMD Metrology:
  - o Continue LBIR and optical development work in support of BMD programs needing traceability to a single source standard (NISY charter) IE LABS, Contractors, Test facilities.
- (700) Integrated Logistics Support:
  - o Integrate BMD logistics efforts and update plans as required.
- (600) Producibility and Manufacturing:
  - o Monitor P&M issues of individual elements and weapons systems.
- (27,457) Specialty Engineering Support:
  - o Update Survivability Program Master Plan, and System Validation Plan.
  - o Use Surveillance Test Bed to assist in planning live fire tests and continue UK data fusion development to support TMD and NMD TRP applications.
  - o Enhance C2 Sims and simulations to focus on critical engineering/integration issues.
  - o Identify and assist in resolution of system level engineering integration issues for senior leadership.
  - o Provide the Services system engineering and integration support for their BMD engineering design and development requirements.

(U) Program Plan to Completion:

- o The NMD/TRP system engineering and integration (SE&I) effort will either ramp up to support a decision to develop contingency deployment or stop at the completion of the NMD/TRP.
- o The TMD SEI effort will continue through Demonstration/Validation (DEM/VAL) and Engineering Manufacturing Development (EMD) phases of the TMD system.
- o System survivability, metrology, ILS, P&M, C2 Sim, and software are continuing specialty engineering programs for TMD and NMD/TRP.

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- o All capabilities developed under this program have applications throughout the weapon system life-cycle.

D. (U) WORK PERFORMED BY:

(U) System Engineering and Integration:

- o Martin Marietta Strategic Systems Division - Blue Bell, PA; Los Angeles, CA; Washington, D.C.;
- o Colorado Springs, CO; Huntsville, AL.
- o Riverside Research Institute (RRI) - Washington D.C. (BMDO).
- o BDM, McLean, VA.
- o Institute for Defense Analyses (IDA), Alexandria, VA.
- o National Institute of Science and Technology - Gaithersburg, MD and Boulder, CO.
- o USAF Aerospace Guidance and Metrology Center - Newark AFB, OH.
- o The Analytical Sciences Corporation (TASC) - Rosslyn, VA.
- o Scientific Applications International Corporation - San Diego, CA.
- o National Test Facility (NTF) - Falcon AFB, CO.
- o Vanguard Research, Inc. - Fairfax, VA.
- o Booz-Allen and Hamilton Inc. - Arlington, VA
- o Nichols Research Corp. - Huntsville, AL.
- o COLSA, Inc. - Huntsville, AL.
- o Teledyne Brown Engineering - Huntsville, AL.
- o SRS Inc. - Huntsville, AL.
- o Raytheon - Bedford, MA.
- o Coleman Research Corporation, Huntsville, AL.
- o Army TMD Program Office - Huntsville, AL.
- o CAS, Huntsville, AL.

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E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

1. TECHNICAL CHANGES: All SE&I work related to Global Protection and space based weapons has ceased. Following the results from the BUR, the NMD/TRP SEIC scope of work was reduced and focused to support continued integration of TMD weapons system programs and definition of NMD/TRP program. TMD SEIC scope of work has remained essentially the same as FY93, focussing on priority engineering issues.
  - o Engineering of TMD system links to global protection and space based weapons has stopped.
  - o Restructure System Survivability Program for TMD and NMD/TRP.
  - o Implement BMD Directive 4280, BMD System Survivability policy.
2. SCHEDULE CHANGES:
  - o FY95 SEIC contract initiated.
  - o BMD System Engineering Environment Efforts (SEE) cancelled.
3. COST CHANGES:
  - o Systems Engineering and Integration Activities for FY94 were 30% of the FY93 level, FY95 activities will increase from the transitional FY94 level to support TMD integration activities and interoperability planning as well as increased NMD TRP contingency planning.

F. (U) PROGRAM DOCUMENTATION:

Document Control No.	Title	Date
o BMD-R-SD-92-000025B	System and TMD Requirement Documents	06/25/93
o BMD-P-SD-92-00005	BMD Navigation Standard	06/23/93
o BMD-R-SD-93-000001-01	BMD Threat-Derived Engineering Design Assumptions	06/23/93
o BMD-R-SD-92-000004	and Parameters Document (Vol. 1 Strategic, (Vol. 2 Theater)	06/23/93
o BMD-R-SD-92-000002-A	BMD System Description Doc. (SDD), Vol 1 and 2 (including TMD)	12/09/92

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0	BMD-R-SD-92-000025-B	BMD Facilities Requirements and Standards Document (FR&SD)	06/25/93
0		TMD C <sup>3</sup> I Requirements Documents	TBD
0		Space-Based Warning System/Theater Interface Rqmts Doc (IRD)	TBD
0	BMD-S-SD-92-000007	BMD System/BMC <sup>3</sup> Program Protection Plan	09/25/92
0	BMD-S-SD-92-000010	BMD System Configuration Management Plan	09/02/93
0	BMD-S-SD-93-000003	BMD Integrated Logistics Support Plan	TBD
0	BMD-T-SD-92-000001	BMD Master Program Schedule	05/21/93
0	BMD-T-SD-93-000001	BMC <sup>3</sup> Information Architecture	12/11/93
0	BMD-X-SD-91-000001	System Specification for BMD Software Engr. Env. (SEE)	12/14/92
0	BMD-X-SD-92-000003	Level 2 System Simulator Build 1 Rqmts. Specifics.	11/26/91
0		BMDO Directive 3405, Revision, BMDO Software Policy	10/92
0	BMD-S-SD-92-000005	BMDO Software Engineering Acquisition Guidelines	03/93
0	BMD-S-SD-91-00001-01	Computer Resources Life-Cycle Mgmt. Plan (CRLCMP)	TBD
0		Software Engineering Support Env. (SESE) Specification	06/30/93
0		Trusted Software Development Methodology (TSDM)	06/92
0		Update BMD Supportability Policy, BMD Dir. 5005 for ILS	3Q/FY94
0		C2 Simulator (ARGUS) Version 9.0-12.0 Document	2Q/FY93/4Q/FY94
0		C2 Simulator Program Plan	2Q/FY94
0		System Survivability Program Master Plan	4Q/FY94
0		BMDO Dir. 4280, Rev 1, BMDO System Survivability Policy	2Q/FY95

G. (U) RELATED ACTIVITIES:

0	PMA 2300, Command and Control Element	PE No. 0603217C
0	PMA 3308, Level II System Simulator	PE No. 0603217C
0	PMA 3312, National Test Bed (NTB)	PE No. 0603217C
0	PMA 1105, Discrimination	PE No. 0603217C
0	PMA 1501, Survivability	PE No. 0603217C

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## FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C/0603217C

PE Title: Theater Missile Defense / Ballistic Missile Defense (U)

Project Number: 3101  
Budget Activity: 03  
Adv Technology Dev (U)  
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- o PMA 2104, GBR
- o PMA 3306, Advanced Research Center
- o Theater Missile Defense
- o National Test Bed
- o PMA 2202, GBI

- PE No. 0603217C
- PE No. 0603217C
- PE No. 0603216C
- PE No. 0603217C
- PE No. 0603217C

H. (U) OTHER APPROPRIATION FUNDS: None

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS:

- o BMD0 has memoranda of agreement with defense agencies of five other nations. The agreement with the United Kingdom is applicable for C2 Simulation activities in FY95.

J. (U) MILESTONE SCHEDULE:

- o Conduct CONEX (CONOPS Exercise) 94A
- o Deliver C2 Simulator (ARGUS) Ver. 11.0
- o System Maturity Matrix
- o Update ILS Plan
- o Update Software policy, standards and Trusted Software Develop. Meth
- o System Survivability Program Master Plan
- o Award of Follow-On SEIC/BMC3 development contract
- o Update CRLCMPs
- o TMD UOES capability
- o Conduct CONEX (CONOPS Exercise) 95A
- o Conduct CONEX (CONOPS Exercise) 95B
- o Deliver C2 Simulator (ARGUS) Ver. 12.0
- o Conduct CONEX (CONOPS Exercise) 95C

- 2Q/FY94
- 2Q/FY94
- 3Q/FY94
- 3Q/FY95
- 3Q/FY94
- 4Q/FY95
- 4Q/FY95
- 4Q/FY95
- 4Q/FY98
- 2Q/FY95
- 3Q/FY95
- 2Q/FY95
- 4Q/FY95

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 3107  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

A. (U) RESOURCES: (\$ in Thousands)  
(U) Project Title: Environment, Siting and Facilities

Program Name:	FY1993	FY1994	FY1995	FY1996	FY1997	FY1998	FY1999	Total
0603217C RDT&E	<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Program</u>
0603217C MILCON	5,130	5,606	5,606	5,606	5,606	5,606	5,606	Continuing
	0	2,727	530	2,992	2,082	2,725	2,325	Continuing

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) Provide environmental impact analysis documentation and real property facility siting and acquisition support for the BMDO systems and technology projects. Plan, program, budget and monitor facility acquisition of Military Construction (MILCON) and RDT&E construction projects. Provide guidance and manage the Environmental Assessments and Environmental Impact Statement process, as applicable, for BMDO technology demonstrations and test and evaluation activities. Develop guidance for Executing Agents on facility siting and acquisition and environmental matters.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1993 Accomplishments:

o (\$2.985M) Continued siting criteria development and environmental documentation for critical BMD test and evaluation programs (TMD Ranges EIS, USAKA System Test, Wake Island EA, BMD and TMD EISs, HERA EA, and THAAD EA)

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 3107

Budget Activity: 03

Adv Technology Dev (U)

February 1994

- o (\$0.345M) Completed facility planning in support of technology demonstrations and test and evaluation activities, with emphasis on TMDI test facilities and the USAKA System Test Site.
- o (\$1.800M) Executed and managed the FY93-95 Military construction, Minor Military Construction, and RDT&E facility design and construction projects and activities with emphasis on the National Test Facility and progressing with the TMD initiative's facility requirements.

(U) FY 1994 Plans:

- o (\$4.146M) Continue Siting criteria development and environmental documentation for critical BMD technology demonstrations and test and evaluation programs (Complete the TMD Ranges EIS, Wake Island EA, BMD and TMD Programmatic EISs, USAKA Supplemental EIS, HERA EA, and THAAD EA. Initiate siting analysis for extended range testing for TMD and System Test Site).
- o (\$0.220M) Continue real estate facility planning in support of technology demonstrations and test and evaluation activities, with emphasis on TMDI test facilities.
- o (\$3.967M) Execute and manage the FY94-96 Military Construction, Minor Military Construction, and RDT&E facility design and construction projects and activities to progress with the TMD initiative's facility requirements (TMD GBR maintenance facility and UOES site work, THAAD training/maintenance storage, and target launch complexes).

(U) FY 1995 Plans:

- o (\$2.020M) Develop siting and basing deployment plans and environmental documentation for critical BMD technology demonstrations test and evaluation programs (Site-specific issues for TMDI garrisoning and fielding)
- o (\$0.550M) Complete facility planning in support of technology demonstrations and test and evaluation activities, with emphasis on TMDI garrison facilities
- o (\$3.566) Execute and manage the FY95-97 Military Construction, Minor Military Construction, and RDT&E facility design and construction projects and activities with emphasis on completing the TMD initiative's facility requirements

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 3107  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

(U) Program Plan to Completion: This is a continuing program.

D. (U) WORK PERFORMED BY:

(U) Facility planning and execution is performed by mainly the US Army, US Air Force, and US Navy facility engineers, with significant activities accomplished by the US Army Corps of Engineers and the Naval Facilities Engineering Command. BMDO activities are supported by a government staff, with research accomplished by The Harris Group. The US Army Space and Strategic Defense Command is supported by Teledyne Brown Engineering and the Earth Technology Company.

E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

1. TECHNICAL CHANGES:

2. SCHEDULE CHANGES:

3. COST CHANGES:

F. (U) PROGRAM DOCUMENTATION:

o	Site specific environmental analysis for technology demonstration and test and evaluation activities	4Q/FY94
o	Site selection analysis documentation	4Q/FY94
o	Facility Acquisition Management Plan	4Q/FY94
o	Independent cost estimates for facilities	4Q/FY94
o	Command support facility requirements documents	4Q/FY94
o	Site specific facility programming documents	4Q/FY94
o	Design and cost authorizations	4Q/FY94
o	Facility designs	4Q/FY94
o	MOUs/ISSAs with host installations	4Q/FY94

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## FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 3107  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

G. (U) RELATED ACTIVITIES: Provides Environment, Siting, and Facilities Engineering support for all BMDO projects. There is no unnecessary duplication of effort within BMDO or the DoD.

H. (U) OTHER APPROPRIATION FUNDS: MILCON: FY93: \$0.0M; FY94: \$2.727M; FY95: \$0.53M.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

J. (U) MILESTONE SCHEDULE:

0	Complete USAKA Supplemental EIS	1Q/FY94
0	Update BMDO Facility Acquisition Strategy Plan	2Q/FY94
0	Physically complete NTF Construction	1Q/FY94
0	Complete TMD Programmatic EIS	1Q/FY94
0	Complete TMD Extended Test Ranges EIS	3Q/FY94
0	Complete BMD EIS	3Q/FY94
0	Complete facility requirements documentation for FY95 and 96 program	2Q/FY94
0	Complete environmental planning for FY94-96 program	2Q/FY94
0	Update BMDO Facility Acquisition Strategy Plan	2Q/FY95
0	Complete design of FY95 MILCON	2Q/FY95
0	Complete facility requirements documentation for FY97 program	2Q/FY95

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C/0603217C

PE Title: Theater Missile Defense/Ballistic Missile Defense (U)

Project Number: 3201  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

A. (U) RESOURCES: (\$ in Thousands)  
Project Title: Architecture & Studies

Program Name:	FY1993 Actual	FY1994 Estimate	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	Total Program Continuing
0603216C RDT&E	32,605	26,675	42,161	48,361	51,980	59,138	51,281	
0603217C RDT&E	34,647	11,000	8,000	8,000	8,000	8,000	8,000	

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) This project performs systems analyses in three broad areas: 1) theater missile defense architectures, 2) alternative ballistic missile defense architectures and concepts, and 3) mission analyses and simulations.

(U) The theater missile defense analyses involve a wide variety of boost-phase intercept implementations, joint BMC3I architecture trades, attack operations concepts, functional studies for allied applications, plans and techniques for integration across theater missile defense pillars, and examinations of how new theater missile defenses will integrate into existing US and allied air defense architectures.

(U) The alternative ballistic missile architectures and concepts area conducts independent studies of element designs, architecture performance, alternative architectures and their performance, architecture costs, and insertion of emerging technologies into the system elements to reduce costs and increase effectiveness.

(U) Mission analyses and simulations focus on definition of ballistic missile defense concepts; the impact of these concepts on international stability, deterrence, and arms control; and strategic and tactical effectiveness of proposed architectures.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C/0603217C

PE Title: Theater Missile Defense/Ballistic Missile Defense (U)

Project Number: 3201  
Budget Activity: 03  
Adv Technology Dev (U)  
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(U) This project includes funding in FY93 for project 3210. Project 3210 is not funded in FY94 or FY95.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1993 Accomplishments:

TMD Architectures (\$31.705M)

- o Completed Pillar Integration Working Group
  - o Conducted Army active defense integration analysis for near-, mid-, and far-term capabilities to develop integration and inter-operability requirements of upper and lower tiers within the active defense pillar, between active defense and the other pillars, and with joint service capabilities.
  - o Produced interface documentation for the active defense system of systems.
  - o Defined C3I architecture based on design details from THAAD and GBR.
  - o Refined and added additional features to end-to-end AI-based BM threat discrimination demonstrator; added situational assessment and mobile target locator to extend AI-based Data Fusion demonstrator into C2 demonstrator; conducted excursions and experiments with rule sets on BMDO testbeds.
  - o Supported Israeli ATBM systems engineering analysis of TBM defense architecture.
  - o Supported collaborative European ATBM system analysis.
- Alternative BMD Architectures and Concepts (\$13.915M)
- o Developed Battle Management/C3 concepts for National Missile Defense.
  - o Completed Theater Defense Scoping Study which put in context the relationship between Active Defense and the other elements of Theater Missile Defense.
  - o Examined initial NMD architecture alternatives in detail.

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Program Element: 0603216C/0603217C

PE Title: Theater Missile Defense/Ballistic Missile Defense (U)

Project Number: 3201  
Budget Activity: 03  
Adv Technology Dev (U)  
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- o Determined interceptor radiation hardness requirements.
- o Examined lethality issues with respect to interceptor warheads and hit-to-kill aimpoint selection and recommended improvements to the current development programs.
- o Determined the ability of Brilliant Eyes to provide discrimination and kill assessment.
- o Mission Analyses and Simulations (\$4.664M)
- o Conducted analysis of target handover from surveillance sensor to interceptor.
- o Conducted head-to-head comparison of simulation models to determine strengths and weaknesses of each.
- o Continued deterrence and third world mission analysis.
- o Participated in wargaming, strategic gaming, simulations, and expert roundtables.
- o Maintained and enhanced the Mission Effectiveness Model (MEM) and Exo-atmospheric Discrimination Simulation (XoDis) to support ongoing system analysis and studies.

(U) FY 1994 Plans:

TMD Architectures (\$26.675M)

- o Complete the cooperative UK architecture studies.
  - o Continue Army active defense integration studies to complete interface documentation for the PATRIOT and UOES elements of UTTMDS.
  - o Continue development of AI-based fusion and situation assessment demonstrator.
  - o Continue development of an end-to-end AI-based BM threat discrimination demonstrator.
  - o Initiate study of Israeli-developed concepts for boost phase intercept.
  - o Participate in EUROM, PACOM, and CENTCOM TMD exercises to assess interface/operational requirements issues.
  - o Support Israeli ATBM systems engineering analysis of TBM defense architecture elements.
  - o Support CONOPS development and conduct related campaign analyses.
  - o Conduct engineering analysis for airborne sensor and C2 concepts and related TMD integration.
- Alternative BMD Architectures and Concepts (\$9.75M)

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Program Element: 0603216C/0603217C

PE Title: Theater Missile Defense/Ballistic Missile Defense (U)

Project Number: 3201

Budget Activity: 03

Adv Technology Dev (U)

February 1994

- o Comparison of the government baseline and specific contractor element designs will be made in order to update architecture performance previously determined.
- o Continue investigations of special topics and unique system concepts.
- o Evaluate advanced technology concepts such as the designs of fire-and-forget interceptors that can engage targets using only early warning sensor data.
- o Examine ability of radars to do kill assessment.
- o Kill assessment algorithms for Brilliant Eyes satellite will be developed.
- o Sensitivity of element designs to threat assumptions and operational performance requirements will be determined.
- o Mission Analyses and Simulations (\$1.25M)
  - o Conduct stability analyses for BMD.
  - o Conduct strategic and theater wargaming.
  - o Maintain and enhance the Mission Effectiveness Model (MEM) and Exo-atmospheric Discrimination Simulation (XoDis) to support ongoing system analysis and studies.

(U) FY 1995 Plans:

TMD Architectures (\$42.161M)

- o Support a cooperative ATBM systems analysis with the UK.
  - o Complete study of Israeli-developed concepts for boost phase intercept.
  - o Produce enhanced knowledge-based system prototype.
  - o Participate in exercises.
  - o Support Israeli ATBM systems engineering analysis.
  - o Conduct functional analyses for design and integration of sensors and C4I in theater.
  - o Conduct functional analyses for dual-path warning information for theater.
  - o Support integration of spare assets within TMD through CONOPS refinements and interface specifications.
  - o Support EADTB/TACCSF testbed operations through simulations and engineering analyses.
- Alternative BMD Architectures and Concepts (\$8M)

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C/0603217C

PE Title: Theater Missile Defense/Ballistic Missile Defense (U)

Project Number: 3201  
Budget Activity: 03  
Adv Technology Dev (U)  
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- o Comparison of the government baseline and specific contractor element designs will be made in order to update architecture performance previously determined.
- o Continue investigations of special topics and unique system concepts.
- o Evaluate advanced technology concepts.
- o Mission Analyses and Simulations (\$OM)
- o Conduct studies of Allied and Russian views on BMD issues.
- o Conduct stability analyses for BMD.
- o Conduct theater and strategic simulations, expert roundtables, and wargames.
- o Conduct counter-proliferation analyses for theater and strategic BMD.
- o Maintain the Mission Effectiveness Model (MEM) and the Exoatmospheric Discrimination Simulation (XoDis).
- o Conduct model and simulation assessments and validations.

(U) Program Plan to Completion: This is a continuing program.

D. (U) WORK PERFORMED BY:

TMD Architectures

- o Air Combat Command - Langley, VA (USAF)
- o Army Materiel Systems Analysis Activity, APL, MD
- o ASC - Wright-Patterson AFB, OH
- o Ballistic Research Lab, APL, MD
- o BDM - Huntsville, AL
- o CAS, Coleman Research Corporation - Huntsville, AL
- o ESC - Boston, MA
- o GRC - Washington, DC
- o LTV Missiles and Electronics Group - Dallas, TX
- o MCRADC - Quantico, VA (USMC)

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C/0603217C

PE Title: Theater Missile Defense/Ballistic Missile Defense (U)

Project Number: 3201

Budget Activity: 03

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- o Mitsubishi Heavy Industry - Japan
- o MRJ - Vienna, VA
- o NRC - Washington, DC
- o TRADOC Research Analysis Center, Ft Leavenworth, KS
- o United Kingdom Defense Research Agency
- o US Air Force Space and Missile Center, Los Angeles, Calif.
- o USN Strategic System Program Organization (SSPO) - Arlington, VA (Navy)
- o Various FFRDCs and contracted study corporations
- o Wales - Israel
- Alternative BMD Architectures and Concepts
- o TASC - Arlington, VA
- o BDM - Arlington, VA
- o Riverside Research Inc. - Arlington, VA
- o Sparta Inc. - McLean, VA; Huntsville, AL; & Los Angeles, CA
- Mission Analyses and Simulations
- o Aries Analytics, SRS, TASC, Riverside Research Institute, Booz, Allen & Hamilton, Inc., DSA, ANSER, and General Research Corporation - Arlington, VA
- o GAMA - Falls Church, VA
- o NIPP - Fairfax, VA
- o Rockwell International, TBE, ANSER - Colorado Springs, CO
- o SAIC, SPARC - Omaha, NE
- o SAIC, BDM, CEXEC, and Sparta - McLean, VA
- o US Army Strategic Defense Command, Huntsville, AL
- o US Air Force Space and Missile Center, Los Angeles, Calif.

E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

1. TECHNICAL CHANGES: Reduced level of effort.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C/0603217C

PE Title: Theater Missile Defense/Ballistic Missile Defense (U)

Project Number: 3201  
Budget Activity: 03  
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- 2. SCHEDULE CHANGES: Reflects reduced level of effort.
- 3. COST CHANGES: Reduced funding.

F. (U) PROGRAM DOCUMENTATION:

o Technical Reports As Completed

G. (U) RELATED ACTIVITIES:

- o Theater Missile Defense
- o National Missile Defense
- o This project provides direction and focus for BMD technology development and acquisition efforts.

PE No. 0603216C  
PE No. 0603217C

There is no unnecessary duplication of effort within BMDO or the DoD.

H. (U) OTHER APPROPRIATION FUNDS: None

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: These efforts are governed by MOAs with the UK MOD, the Israeli MOD, and MITI of Japan.

J. (U) MILESTONE SCHEDULE:

- TMD Architectures
- o CINC TMD workshop
- o UK-US AI-based Demonstrator Experiment
- o Israeli Studies and Analysis
- o EUCOM, CENTCOM, and PACOM exercises
- o Enhanced KBS prototype
- o Decision Aids Field Demonstration

1Q/FY94  
2Q/FY94  
1&3Q/FY94  
3&4Q/FY94  
1Q/FY95  
3Q/FY95

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PE Title: Theater Missile Defense/Ballistic Missile Defense (U)

o	AI-based threat discrimination demonstration	FY95
o	Interface Management Document (USA and USAF)	1&4Q/FY94
o	TMD Functional Requirements Document	4Q/FY94
o	Alternative BMD Architectures and Concepts	
o	Technical reports and briefings as work on specific issues as completed	
o	Final Technical Report	4Q/FY94
o	Mission Analyses and Simulations	
o	Status Reports on Army and Air Force analysis.	Quarterly
o	Architecture Analysis Reports	As Completed
o	Final report on study and analysis work completed by contractor(s) in FY 1994	End of FY 94
o	Operational requirements review	FY92-97
o	Deterrence/stability analysis (Annually)	FY92-97
o	Wargames reports (As Required)	FY92-97
o	Command control analysis reports (Annually)	FY92-97
o	Offense-defense concepts of operations (Annually)	FY92-97

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C/0603217C

PE Title: Theater Missile Defense/Ballistic Missile Defense (U)

Project Number: 3202  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

A. (U) RESOURCES: (\$ in Thousands)  
Project Title: Operations Interface

	FY1993	FY1994	FY1995	FY1996	FY1997	FY1998	FY1999	Total
<u>Program Name:</u>								
0603216C RDT&E	<u>Actual</u> 0	<u>Estimate</u> 0	<u>Estimate</u> 2,522	<u>Estimate</u> 2,522	<u>Estimate</u> 2,522	<u>Estimate</u> 2,522	<u>Estimate</u> 2,522	<u>Program</u> Continuing
0603217C RDT&E	8,041	4,373	1,530	1,530	1,530	1,530	1,530	Continuing

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENTS AND SYSTEM CAPABILITIES:

(U) The mission of the Ballistic Missile Defense Organization is to manage, direct, and execute the BMD Program to acquire and develop systems and architectures to (a) deploy theater missile defense capability to protect forward-deployed armed forces of the U.S., friends, and allies; (b) develop options for and deploy when directed, an antiballistic missile system that is capable of providing highly effective defense of the U.S. homeland against limited attacks of ballistic missiles; and, (c) demonstrate advanced technologies for near term insertion options and concept development of new systems. This project supports the operational interfaces that must be provided to both the systems acquisition community and the military operational community. For the acquisition community, this project supports preparations for and execution of the Defense Acquisition Board (DAB) activities for BMD systems. The project also provides analyses of acquisition policies, processes, and plans to develop effective, streamlined means for acquiring BMD systems. On the military operations side, analyses and simulations address systems effectiveness of proposed BMD system architectures against ballistic missile threats to U.S. deployed forces, our Allies and friends. Analytical results are used to support activities required for the Defense acquisition process. Theater and strategic gaming with the CINCs is supported to identify roles, missions, and requirements for BMD. Funds are also provided from this project to operational users to enable them to develop and refine their operational requirements (ORDs) and concepts of operations (CONOPS) for employing BMD and ensuring that these concepts are integrated into the overall BMD system deployment strategy and planning.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C/0603217C

PE Title: Theater Missile Defense/Ballistic Missile Defense (U)

Project Number: 3202

Budget Activity: 03

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(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

C. (U) PROGRAM ACCOMPLISHMENT AND PLANS: Note that linear estimates were used for the following financial information when exact data were not available.

(U) FY 1993 Accomplishments:

o (\$1,161) Continued operational mission effectiveness analysis of BMD systems based on refined architecture and threat definition.  
o (\$925) Continued deterrence and third world mission analysis.  
o (\$2,123) Refined mission requirements for primary/alternate missions.  
o (\$1,300) Developed material acquisition document inputs.  
o (\$129) Conducted command center connectivity analysis.  
o (\$879) Updated offense-defense concept of operations.  
o (\$115) Supported tabletop CINC wargaming, including GLOBAL 93.  
o (\$1,079) Continued command and control analysis of operational requirements.  
o (\$80) Continued wargaming/strategic gaming/simulations/expert roundtables.  
o (\$250) Completed component cost and operational effectiveness analysis.

(U) FY 1994 Plans:

o (\$400) Conduct Patriot PAC-3 Milestone IV DAB.  
o (\$50) Support Aegis Standard Missile Block IV-A DAB.  
o (\$50) Develop and analyze acquisition alternatives and impacts of the revised BMD program.  
o (\$884) Refine Operational Requirements Document (ORDs).  
o (\$1,097) Develop operational concept(s) of operations for BMD.  
o (\$332) Conduct theater and strategic wargaming, including GLOBAL 94.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C/0603217C

PE Title: Theater Missile Defense/Ballistic Missile Defense (U)

Project Number: 3202  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

0 (\$1,040) Conduct mission analysis for BMD.

(U) FY 1995 Plans:

- 0 (\$500) Support acquisition community interfaces.
- 0 (\$1,446) Refine Operational Requirements Document (ORDs).
- 0 (\$1,030) Develop operational concept(s) of operations for BMD.
- 0 (\$450) Conduct theater and strategic wargaming, including GLOBAL 95.
- 0 (\$626) Conduct mission analysis for BMD.

(U) Program Plan to Completion: This is a continuing program.

D. (U) WORK PERFORMED BY:

- 0 SAIC, BDM, CEXEC, and Sparta - McLean, VA
- 0 BDM, TASC - Rosslyn, VA
- 0 Aries Analytics, SRS, TASC, Riverside Research Institute, Booz, Allen & Hamilton, Inc., DSA, ANSER, and General Research Corporation - Arlington, VA
- 0 Rockwell International, TBE, ANSER - Colorado Springs, CO
- 0 SPARTA, TBE - Huntsville, AL
- 0 SAIC, SPARC - Omaha, NE
- 0 NIPP - Fairfax, VA
- 0 GAMA - Falls Church, VA

E. (U) COMPARISON WITH FY 1993 DESCRIPTIVE SUMMARY:

1. TECHNICAL CHANGES: Incorporated activities in 4108 and divested activities in 3201.
2. SCHEDULE CHANGES: None
3. COST CHANGES: None

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## FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C/0603217C

PE Title: Theater Missile Defense/Ballistic Missile Defense (U)

Project Number: 3202  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

### F. (U) PROGRAM DOCUMENTATION:

G. (U) RELATED ACTIVITIES: Mission analysis is complementary to mission performance assessment performed by Martin Marietta. There is no unnecessary duplication of effort within BMDO or the DoD.

H. (U) OTHER APPROPRIATION FUNDS: None

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

### J. (U) MILESTONE SCHEDULE:

0	Support acquisition interfaces (As Required)	FY93-98
0	Assess systems military effectiveness (As Required)	FY93-98
0	Operational requirements development (Annually)	FY93-98
0	Wargames reports (As Required)	FY93-98
0	Command control analysis reports (Annually)	FY93-98
0	Offense-defense concepts of operations (Annually)	FY93-98

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Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 3203  
Budget Activity: 03  
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A. (U)	<u>RESOURCES:</u>		(\$ in Thousands)		Intelligence Threat Development		FY1997		FY1998		FY1999		Total	
	<u>Project Title:</u>						<u>Estimate</u>		<u>Estimate</u>		<u>Estimate</u>		<u>Program</u>	
	<u>Program Name:</u>	<u>FY1993</u>	<u>FY1994</u>	<u>FY1995</u>	<u>FY1996</u>									
	0603217C RDT&E	Actual	Estimate	Estimate	Estimate									
		13,987	8,050	8,050	8,050		8,050	8,050	8,050	8,050	8,050	8,050	Continuing	

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) The purpose of the BMD Intelligence Threat Development project is to provide an up-to-date Intelligence Community-validated threat description against which system-specific threat-driven specifications, lethality designs, and target objects are developed. The primary vehicle for providing these threat descriptions is the System Threat Assessment Report (STAR), which is updated and validated by the Intelligence Community annually under this project. The STAR provides a general assessment of these capabilities-doctrine, equipment, and forces-that potential adversaries could use to defeat or degrade the BMD system. In addition to the STAR, annexes, for each Major Defense Acquisition Program (MDAP), are provided and validated by the intelligence community each year. The annexes contain somewhat more information than the STAR and are system-specific to each MDAP. The Intelligence Threat Development Program divides the threat into four major categories-Operational Threat Environment, Targets, and System-Specific Threats, and Reactive Threats. The Operational Threat Environment category includes assessments of the operational, physical and technological environment and projects the effects of those developments and trends on mission capability out to the end-of-life cycle. The outputs often take the form of assessed limits on deployment and employment tactics or strategies for the use of projected threats in attack scenarios. The Targets category includes a projection of threat systems and the countermeasures that enhance their performance. This includes force structure, performance characteristics, limits on employment and control, and where available, sample signatures. The System Specific Threat category includes reconnaissance, surveillance, and target acquisition (RSTA); lethal and non-lethal threats; and regional integrated SST assessments. Both targets and SST are described up to

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four levels of detail. Level 0 is the highest level in terms of basic capabilities and country of origin. Level 1 provides the form, fit and function characteristics necessary to support system tradeoff studies. Level 2 is a very detailed design in which actual materials and structures are described for use in lethality studies and detail element designs. Level 3 is flight target designs with manufacturing blue prints for either signature or lethality testing. Additional analyses evaluate emission signatures, reflection signatures and dynamics signatures (trajectories and microdynamics), and the system specific vulnerabilities for strategic and theater elements of ballistic missile defense systems. The Reactive Threats are divided into high-interest technologically feasible threats and theater missile defense threats. These analyses will provide detailed data for developing both theater defense systems and other ballistic missile defense systems.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:(U) FY 1993 Accomplishments:

0	(3823k)	Classified Program.
0	(1100k)	Upgrade the STAR to reflect the latest changes in the threat environment and any revised program plans.
0	(105k)	Generate Global Missile Defense STAR Annex.
0	(105k)	Generate National Missile Defense Star Annex.
0	(105k)	Generate Battle Management, Command, Control, and Communications STAR Annex.
0	(50k)	Generate Strategic and Theater Intelligence Production Requirements.
0	(200k)	Generate unclassified threat document on missile proliferation.
0	(2100k)	Began 13 Level 1 system descriptions.
0	(500k)	Provided PENAIID Panel Quick Reaction Support.
0	(450k)	Provided PENAIID Level 1 threat specifications.
0	(900k)	Generated three system specific threat specifications.
0	(1500k)	Began three Level 2 system threat descriptions.
0	(1300k)	Provided management planning and budget support (five-year plan, PMAs, etc.).
0	(700k)	Evaluated ROW low observable intelligence assessments.

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o (150k) Generated Theater Ballistic Missile mobile ground operations specifications.

o (150k) Began TBM guidance upgrades.

o (150k) Began CBW agent threat specifications.

o (250k) Generated intelligence parameter database.

o (349k) Began intelligence assessments studies.

(U) FY 1994 Plans:

o (1550k) Deliver an upgraded Capstone STAR.

o (50k) Deliver an upgraded system specific UTMD STAR Annex.

o (50k) Deliver an upgraded system specific PATRIOT TMD STAR Annex.

o (50k) Deliver an upgraded system specific Corps SAM TMD STAR Annex.

o (1580k) Upgrade material on the Operational Threat Environments.

o (50k) Deliver upgraded Intelligence Production Requirements.

o (300k) Begin developing three Level 1 system descriptions.

o (250k) Begin developing MRL threat specifications.

o (300k) Begin developing SRBM projection analysis.

o (175k) Begin developing aerodynamic missile projections analysis.

o (250k) Develop PENAIID Level 1 threat specification.

o (1025k) Begin developing five Level 2 system descriptions.

o (125k) Begin two Level 2 system descriptions.

o (200k) Begin Level 2 SRBM static test instrumentation.

o (400k) Begin one Level 3 system threat description.

o (695k) Provide management and budget support (PMAs, five-year plan, etc.).

o (200k) Develop studies for quick reaction tasks.

o (400k) Support development of standard missile parameter database.

o (400k) Develop and document threat information to support generation of signature information for SRBM targets.

(U) FY 1995 Plans:

o (1550k) Deliver an upgraded Capstone STAR.

o (100k) Deliver an upgraded system specific UTMD STAR Annex.

o (100k) Deliver an upgraded system specific PATRIOT TMD STAR Annex.

o (100k) Deliver an upgraded system specific Corps SAM TMD STAR Annex.

o (1000k) Upgrade material on the Operational Threat Environment.

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PE Title: Ballistic Missile Defense (U)

Project Number: 3203  
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- o (1600k) Carry out intelligence assessments to upgrade STAR.
- o (2000k) Develop Level 1 and Level 2 descriptions for a very limited amount of the highest priority threats within funding to support system specific performance analysis and design to threat development.
- o (1500k) Develop Level 3 test target descriptions.
- o (100k) Deliver upgraded Intelligence Production Requirements.

(U) Program Plan to Completion: This is a continuing program.

D. (U) WORK PERFORMED BY:

- o Alpha Tech, Dynetics, Inc., Nichols Research, Sparta, Inc., SRS Technologies, - Huntsville, AL
- o Teledyne Brown - Huntsville, AL
- o Boeing Aerospace Corporation - Seattle, WA
- o Delta Research, Inc. - Huntsville, AL
- o General Electric, Company - Philadelphia, PA
- o Kaman Sciences - Colorado Springs, CO
- o McDonnell-Douglas Space Systems Company - Huntington Beach, CA
- o Science Applications International Corporation - Dayton, OH
- o Textron - Boston, MA
- o TRW - Redondo Beach, CA
- o Air Force Foreign Aerospace Science and Technology Center - Dayton, OH
- o Army Foreign Science and Technology Center - Charlottesville, VA
- o Army Strategic Defense Command - Huntsville, AL
- o Defense Intelligence Agency - Washington, DC
- o Central Intelligence Agency - Langley, VA
- o DIA Missile and Space Intelligence Center - Huntsville, AL
- o Naval Maritime Intelligence Center - Suitland, MD
- o Lawrence Livermore National Laboratory - Livermore, CA
- o Los Alamos National Laboratory - Los Alamos, NM

E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

1. TECHNICAL CHANGES:

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- 2. SCHEDULE CHANGES:
- 3. COST CHANGES:

F. (U) PROGRAM DOCUMENTATION: (Publication dates under Milestones)

- o Intelligence Threat Program Plan
- o Capstone STAR
- o UTMD STAR Annex
- o Patriot STAR Annex
- o Corps SAM STAR Annex
- o Unclassified Third World Missile Threat
- o Level 1 Threat description compendiums and individual designs for very high, high, and medium likelihood threat forces in system analyses.
- o Selected Level 2 Threat descriptions on individual designs for threat forces in detail element analyses.

G. (U) RELATED ACTIVITIES:

(U) The Threat Program involves organizations of the Army, Navy, Air Force, and the Office of the Secretary of Defense (e.g., the Joint Chiefs of Staff and the Defense Intelligence Agency). Activities are defined in Program Management agreements with the Services. Coordination is accomplished through daily monitoring of activities and periodic meetings with representatives from the Services, Agencies, and the Department of Defense to ensure that product quality is maintained, that schedules are being met, and that there is no unnecessary duplication.

H. (U) OTHER APPROPRIATION FUNDS: None

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

J. (U) MILESTONE SCHEDULE:

- o Update UTMDS STAR annex in DoD 5000.2 format 3Q/FY94
- o Update Patriot STAR annex in DoD 5000.2 format 3Q/FY94
- o Update Corps SAM STAR annex in DoD 5000.2 format 3Q/FY94

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Program Element: 0603217C

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0	Deliver updated and validated Capstone STAR	4Q/FY94
0	Upgrade Capstone STAR and 3 Annexes	3Q/FY95
0	Upgrade Capstone STAR and 3 Annexes	3Q/FY96
0	Level 1, 2 and 3 Threat descriptions are delivered as funding permits	

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Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 3204  
Budget Activity: 03  
Adv Technology Dev (U)  
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A. (U) RESOURCES: (\$ in Thousands)  
Project Title: Countermeasures Integration

	FY1993	FY1994	FY1995	FY1996	FY1997	FY1998	FY1999	Total
Program Name:	Actual	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Program
0603217C RDT&E	16,916	16,303	18,303	18,303	18,303	18,303	18,303	Continuing

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) The mission of the BMDO and Countermeasure Integration (CMI) Program is to stress BMD systems and architectures to ensure that deployed ballistic missile defense systems are robust to potential countermeasures which are within the means of anticipated adversaries. Included in this mission is a twofold responsibility. First, the CMI program supports the BMD threat development process by stimulating the examination and assessment of all credible counters to future deployed systems. Secondly, the CMI program provides the BMDO system designer with advance warning necessary for building preplanned improvements and program hedges into the design.

(U) The BMDO CMI Program carries out its mission by pursuing the following objectives: review BMD systems for susceptibilities and identify potential countermeasures; determine credibility through analyses and tests; characterize credible countermeasures by providing designs and performance parameters; inform intelligence and system threat developers of potential countermeasures; and inform BMD system designers with advance warning of potential countermeasures. The support provided by the CMI Program to the threat development process and its outcome is the chief means by which the program achieves its mission of ensuring the robustness of future deployed systems. Making vulnerability and susceptibility information available to the system designers provides a mechanism by which the designers can build robustness into their designs during early stages of the system development process. The ability to improve the robustness of the design in its formative stages provides a cost-effective means of ensuring a flexible high performance design. Timely screening of countermeasures also allows the

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system designer to focus on the critical countermeasures and safely ignore countermeasures which ultimately prove to be technically, politically, militarily or economically infeasible.

(U) The CMI Program uses three primary resource groups to execute the process of countermeasure identification, analysis, verification and assessment. These three resource groups are the Red Teams, laboratories, and strategic analysis groups. Red teams are formed and tasked to identify and analyze potential countermeasures to a BMD system architecture. The laboratories and the contractor are responsible for verification of the technical feasibility of potential countermeasures. The strategic analysis groups provide assessments of the reality of potential countermeasures within the total context of the adversary's environment. Through this framework, the CMI program is able to access an array of countermeasure evaluation resources from government agencies, national laboratories, and contractors.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1993 Accomplishments:

- 0 (439k) On-going Red/Blue Exchange on TMD systems.\*
- 0 (780k) On-going Red/Blue Exchange on NMD systems.\*
- 0 (270k) Analyze selected NMD CM to support threat specification development.\*
- 0 (360k) Do CM position papers to support System Engineering and STAR updates.\*
- 0 (200k) Perform STB pilot program experiments on NMD-GBR CM.\*
- 0 (4250k) On-going technical tests and evaluations of NMD CM.
- 0 (2150k) Analyze, report, publish results of test and evaluation of CM.
- 0 (1935k) Support on-going TMD Program by developing targets for TCMP 1 & 2.

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Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 3204  
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- o (4532k) Begin to implement DSB recommendations: CM Skunkworks Pilot Program.
- o (460k) Provide Senior Level oversight of Red/Blue Exchanges.\*
- o (1340k) Develop databases on CM-related issues and quotations.\*
- o (200k) Study selected ROW nation propensity for CM development.\*
- \* Costs supplemented with funds carried over from FY92.

### (U) FY 1994 Accomplishments/Plans:

- o (1150k) On-going effort: develop, define and evaluate TMD CM.
- o (1400k) On-going Red/Blue Exchange against evolving TMD Architecture.
- o (600k) Focus limited Red/Blue effort on TMD-BM/C3 function.
- o (230k) On-going STB experiments oriented on TMD CM.
- o (4846k) On-going technical tests and evaluations of TMD CM.
- o (330k) Begin launch vehicle modification to support CM tests.
- o (6050k) On-going emulation of ROW CM development - CM Skunkworks.
- o (485k) Provide Senior level oversight of Red/Blue Exchanges.
- o (552k) Perform non-technical analysis of ROW CM propensity.
- o (660k) Maintain and expand CM-related databases (ROW & QMD).

### (U) FY 1995 Plans:

- o (1633k) On-going effort: develop, define and evaluate TMD CM.
- o (1250k) On-going Red/Blue Exchange against specific TMD systems.
- o (1200k) Focus limited Red/Blue effort on TMD-Kill Assessment.
- o (300k) On-going STB & NTB experiments oriented on TMD CM.
- o (5250k) On-going technical tests and evaluations of TMD CM.
- o (330k) Continue launch vehicle modification to support CM tests.
- o (6650k) On-going emulation of ROW CM development - CM Skunkworks.
- o (500k) Provide Senior level oversight of Red/Blue Exchanges.
- o (590k) Perform non-technical analysis of ROW CM propensity.

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- o (600k) Maintain and expand CM-related databases (ROW & QMD).

(U) Program Plan to Completion: This is a continuing program.

D. (U) WORK PERFORMED BY:

- o Science Applications International Corporation - (prime contractor)
- o System Planning Corporation - Arlington, VA (prime contractor)
- o MIT/Lincoln Laboratories - Lexington, MA
- o Sandia National Laboratories - Albuquerque, NM
- o Space and Missile System Center/Detachment 10, Norton AFB - San Bernardino, CA
- o US Army Space and Strategic Defense Command - Huntsville, AL
- o USAF Phillips Laboratory, Kirtland AFB, NM

E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

1. TECHNICAL CHANGES: Analyses and tests concentrate on TMD countermeasures.
2. SCHEDULE CHANGES: Deleted a planned TMD Low-Endo follow-on Red/Blue Exchange in favor of a more complete TMD architecture Red/Blue Exchange in FY 94-95. Delayed endoatmospheric potential countermeasure designs from FY 94 to FY 95.
3. COST CHANGES: The FY 94 CMI Budget was reduced by 27% causing a reduction in countermeasure investigations and technical evaluations which in turn reduces the information available to system designers for improving the robustness of their designs prior to milestone decisions.

F. (U) PROGRAM DOCUMENTATION: Statement of Work from Contract Numbers BMD084-91-C-0011, 0012, and 0019, 1 August 1991, and technical descriptions under PMA Number 3204.

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G. (U) RELATED ACTIVITIES:

- o The countermeasure and threat projects involve organizations of the Army, Air Force, and Department of Energy (DOE). Activities are defined in Program Management Agreements (PMAs) for the Services, Federally Funded Research and Development Centers, DOE, and the prime contractors. TMD benefits from this work through improvements to system robustness.
- o Coordination is accomplished through daily monitoring of activities and a weekly technical interchange and direction meeting with prime contractor management.
- o There is no unnecessary duplication of effort within BMDO and DOE.

H. (U) OTHER APPROPRIATION FUNDS: None.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: Joint technical assessments and experiments are executed under the BMDO Cooperative Research Exchange (SCORE) with the U.K.

J. (U) MILESTONE SCHEDULE:

- |   |   |          |
|---|---|----------|
| o | Conclude NMD 1st Site Red/Blue Exchange               | 1Q/FY94  |
| o | Complete TMD Low-Endo Red/Blue Exchange               | 2Q/FY94  |
| o | Complete STB experiment for GBR/THAAD countermeasures | 3Q/FY94  |
| o | Complete TMD Architecture Red-Blue Exchange           | 2Q/FY95  |
| o | Conduct Skunkworks SM-1 Flight Test                   | 1Q/FY94  |
| o | Conduct Skunkworks SM-2 Flight Test                   | 3Q/FY94  |
| o | Conduct Skunkworks SM-3 Flight Test                   | 4Q+/FY94 |

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Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 3206  
Budget Activity: 03  
Adv Technology Dev (U)  
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A. (U) RESOURCES: (\$ in Thousands)  
Project Title: System Threat

	FY1993	FY1994	FY1995	FY1996	FY1997	FY1998	FY1999	Total
<u>Program Name:</u>	<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Program</u>
0603217C RDT&E	9,229	6,890	6,890	6,890	6,890	6,890	6,890	Continuing

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) With the changing world situation and the projection of continuing proliferation of ballistic missiles, it is imperative that an accurate characterization of theater, national, and global threats be developed. The accurate specification and characterization of ballistic missiles and the appropriate development and integration of scenarios using these characterizations is critical to: (1) the analysis of alternative ballistic missile defense architectures; (2) the performance assessments of potential technology applications; and (3) the operational performance evaluations of candidate designs. The threat specifications and characterizations must be based on accepted intelligence community threat projections or realistic estimates of technological/operational innovations; be traceable back to objective and quantifiable analyses; and be supported by the using organizations. These threat projections, described in engineering terms and parameters, must be used by all BMDO agencies to ensure that results can be compared and contrasted.

(U) The System Threat development project is an integral part of BMDO's three-part Threat Program. The System Threat Project uses as a baseline the System Threat Assessment Report (STAR) developed under the Intelligence Threat Development Project (#3203) and incorporates likely adversary countermeasures identified in the Countermeasures Integration Project (#3204). The System Threat Project adds system-specific engineering characterization details described in the form of scenarios characterizing particular timing, targets, and tactics.

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PE Title: Ballistic Missile Defense (U)

(U) The System Threat Project achieves its objectives through cooperative efforts with the Intelligence Community, BMD system developers and supporting contractors. Using the expertise available through these entities, the System Threat Project:

- (1) Identifies user needs for threat scenario descriptions.
- (2) Identifies analyses needed to fully specify and characterize the threat missile systems, penetration aids, tactics, etc., and ensures the analyses for review and comment.
- (3) Provides the analysis results to all interested agencies for review and comment.
- (4) Addresses critical threat issues which arise during the analysis process.
- (5) Ensures all supporting agencies' views on threat issues are fully aired.
- (6) Reviews, approves, produces, and distributes all System Threat Scenario Descriptions.
- (7) Produces threat computer tapes and supporting documentation for use by the development and acquisition communities.

(U) The System Threat Scenario Description Documents are presented to the BMDO System Design Board (SDB) for endorsement and configuration control.

(U) As a result of the Bottom-Up Review (BUR), the funding for the System Threat scenario generation effort was reduced by 30% for FY94 and increasing in follow-on years. The 30% reduction primarily impacts on the timeliness of scenario production versus the need for scenarios to complete COEA and DAB required analyses.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

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C. PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1993 Accomplishments:

- o Update all scenario descriptions to reflect the latest version of the STAR.
- o Develop threat excursions for architecture concept studies.
- o Continue upgrade of the threat tape generator, TM93.
- o Perform analyses to develop threat system, penails, and characterization data.
- o Support test and experiment activities.
- o Preparation of threat documentation to support element milestone decisions.
- o Continue operation of the Special Programs Center at the NTB.
- o Develop single-event (non-campaign), campaign, and special purpose scenarios as needed by the user community.
- o Update work on the START constrained, non-responsive threat systems and scenarios in response to changing treaty interpretation.
- o Develop scenarios which reflect possible BMD applications in the context of:
  - Exchanges from and to old Soviet Republics
  - An amphibious landing scenario
  - A defense suppression scenario
  - A counterforce scenario.
- o Continue to support the Countermeasures Integration Program efforts to define, assess, test, and evaluate candidate countermeasures, and to conduct Red/Blue interchanges.

(U) FY 1994 Plans:

- o Update the BMD Scenario Descriptions to reflect latest intelligence program projections contained in the STAR.
- o Develop threat system characterizations, and scenario descriptions in response to the analysis needs of the system/element developers.
- o Develop threat scenarios for use in cost, effectiveness and architecture analysis studies.

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- o Continue to integrate ballistic missile, cruise missile, and aero-dynamic threat systems in campaign-style scenarios.
- o Continue to support the System Design Board's need for threat issue briefings and discussions during the requirements definition decision meetings.
- o Continue upgrade of the National Test Bed (NTB) threat system modeling capability (TM93).
- o Continue to produce threat tapes and supporting documentation through the NTB Special Programs Center.
- o Continue to support the Intelligence Office's efforts to update the STAR.
- o Support system and element project offices with preparation of required threat documentation in support of acquisition milestones.
- o Develop scenarios depicting threat systems employed in theater environments
- o Continue to support the inclusion of Electronic Warfare overlays which characterize electronic threat systems in scenario constructs.
- o Continue to support the inclusion of Pre-launch Operations studies which characterize signatures of infrastructure activities in scenario constructs.

(U) FY 1995 Plans: Same as FY 1994 Plans.

(U) Program Plan to Completion: This is a continuing program.

D. WORK PERFORMED BY:

- o US Air Force Space and Missile Center, Los Angeles, CA
- o US Air Force National Aerospace Intelligence Center, Dayton, OH
- o Defense Intelligence Agency, Washington, DC
- o US Army Missile and Space Intelligence Center, Huntsville, AL
- o Navy Maritime Intelligence Center, Suitland, MD
- o BMDO Security, Intelligence and Countermeasures Directorate, Pentagon, Washington, DC

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 3206  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

- o US Army Strategic Defense Command, Huntsville, AL
- o Joint Program Office of the National Testbed, Falcon AFB, CO
- o Booz-Allen & Hamilton, Arlington, VA
- o Riverside Research, Arlington, VA

E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

- 1. TECHNICAL CHANGES: None
- 2. SCHEDULE CHANGES: None
- 3. COST CHANGES: Funding for the System Threat scenario generation effort was reduced by 30% for FY94 and increasing in follow-on years. The reduction primarily impacts on the timeliness of scenario production versus the need for scenarios to complete COEA and DAB required analyses. Scenarios being generated to support TMD analyses will not be completed on time due to this reduction. NTF/SPC personnel reduced by 7 individuals. Scenarios to be used by TMD programs for analysis will have completion delayed by 2-3 months. Aerodynamic threat data integration into threat scenario magnetic media will be delayed at least 6 months.

F. (U) PROGRAM DOCUMENTATION:

- |   |                                      |          |
|---|--------------------------------------|----------|
| o | Design-to-Threat                     | 1Q/FY-89 |
| o | 91 STAR                              | 2Q/FY-92 |
| o | 91-2                                 | 4Q/FY-92 |
| o | 92-1 Middle East Scenario            | 1Q/FY-92 |
| o | 92-2 North East Asia Scenario        | 1Q/FY-93 |
| o | 92-3 Middle East Amphibious Scenario | 2Q/FY-93 |
| o | BMD 93-1 South East Europe Scenario  | 1Q/FY-94 |

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 3206  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

G. (U) RELATED ACTIVITIES: Work performed under the Intelligence Threat Development Project and the Countermeasures Threat Project (Projects 3203 and 3204, PE No. 6.3) complement and support this effort. There is no unnecessary duplication of effort within BMDO or the DoD.

H. (U) OTHER APPROPRIATION FUNDS: None

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

J. (U) MILESTONE SCHEDULE:

o	Update Scenario Description Documents (as required)	FY92-97
o	TM93 Software Upgrades (Annually)	FY92-97
o	Threat Tape Production (as required)	FY92-97
o	Develop Red/Blue Interchange Scenario (semi-annually)	FY93-98
o	START Constrained Global Scenario/Tape	2Q/FY-94
o	Update all Scenarios vs 94 STAR	4Q/FY-94
o	Additional Scenarios Per Users Needs	FY94-98
o	START II Strategic Scenario	1Q/FY-94
o	Southwest Asia North Scenario	2Q/FY-94
o	Southwest Asia South Scenario	2Q/FY-94
o	PENAIID Compendium	1Q/FY-94
o	BMDO Scenario Catalogue	1Q/FY-94
o	Asia Campaign Scenario	1Q/FY-95

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FY1994 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604216C/0604225C  
PE Title: Theater Missile Defense (U)

Project Number: 3211  
Budget Activity: 04/05  
Dem/Val/EMD (U)  
February 1994

A. (U) RESOURCES: (\$ in Thousands)  
Project Title: C<sup>4</sup>I Concepts Ops Anal

Program Name:	FY1993 Actual	FY1994 Estimate	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	Total Program
0208060C PROC	0	0	0	0	51,320	67,710	0	Continuing
0604216C RDT&E	8,800	12,567	33,500	20,129	20,925	22,052	18,620	Continuing
0604225C RDT&E	0	0	555	16,166	22,976	23,491	34,780	Continuing

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) C<sup>4</sup>I, in the context of this project, is defined as all those command, control, and intelligence functions serviced by computers and communications systems beyond weapon control functions. This project assumes theater missile defense is an extension of the traditional air defense. As such, TMD will integrate into the existing theater air defense command and control structure. This project contains those upgrades required to meet the dynamics of ballistic missile defense in a theater air defense structure. Integration of sensors and communications systems will provide enhanced support, not only to active defense, but to attack operations and passive defense as well.

(U) This effort includes analyzing known and planned unified theater air defense CONOPS and C<sup>4</sup>I architectures; identifying information types and information flows based on stratagems and use; determining the optimum architecture via trade studies; prototyping of a tactical operation center to integrate Army TMD assets; initiating upgrades to Air Force command and control nodes; making improvements for the dissemination of attack warning, target acquisition, cueing and command information to battlefield systems; and developing a standard message set that will support the TBM mission.

(U) The Bottom-Up Review (BUR) had no effect on this program.

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FY1994 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604216C/0604225C

PE Title: Theater Missile Defense (U)

Project Number: 3211  
Budget Activity: 04/05  
Dem/Val/EMD (U)  
February 1994

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

C. PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1993 Accomplishments:

(\$8,800) C<sup>4</sup>I Integration

- o Initiated TMD subgroup for TMD upgrades to TADIL J.
- o Produced draft and revised TADIL J interface change proposals (ICP).
- o Presented draft TADIL J ICP to NATO Data Link Group.
- o Analyzed loading and availability of Joint TMD net.
- o Analyzed TMD C<sup>3</sup>I in support of NATO Research Study Group 16 using The Extended Air Defense Simulation (EADSIM).
- o Demonstrated Tactical Operations Center (TOC) prototype during Roving Sands exercise.
- o Initiated Tactical Processing Working Group.
- o Upgrades to the modular control equipment for the Air Operations Center.

(U) FY 1994 Plans:

- (\$5,266) C<sup>4</sup>I Integration - Army
- o Begin prototyping of Air Defense Command Post.
  - o Demonstrate C<sup>2</sup> connectivity to national assets.

(\$5,701) C<sup>4</sup>I Integration - Air Force

- o Demonstrate Operations Concept Demonstration (OCD) II and C<sup>4</sup>I connectivity in Roving Sands 94 exercise.

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FY1994 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604216C/0604225C  
PE Title: Theater Missile Defense (U)

Project Number: 3211  
Budget Activity: 04/05  
Dem/Val/EMD (U)  
February 1994

- o Develop gateway concepts and conduct trade-offs.
  - o Develop decision support aids for JFACC battle management.
- (\$1,730) C'I Integration - Joint
- o Conduct surveillance data fusion study.
  - o Obtain Configuration Control Board approval of TMD message standard.
  - o Initiate and complete Tactical Information Broadcast Service (TIBS) correlation algorithm.
  - o Apply open architecture approaches to TMD System Exerciser interfaces.
  - o Initiate development of NATO TMD message standard.
  - o Develop operational interfaces among TRAP/TIBS/CIIP message sets.
  - o Conduct TMD wargame.

(U) FY 1995 Plans:

- (\$10,882) C'I Integration - Army
- o Integrating prototype capabilities into Air Defense TOC weapon systems.

(\$18,733) C'I Integration - Air Force

- o Develop TMD intelligence support template.
- o Develop TMD message software
- o Develop implementation plan for TMD messages on USAF platforms.
- o Complete AOC automation under CIAPS.

(\$3,885) C'I Integration - Joint

- o Continue TMD wargame.
- o Develop implementation plan for TMD messages on Navy platforms.
- o Obtain NATO approval of TMD message standard.

- (U) Program Plan to Completion: This is a continuing program.

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FY1994 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604216C/0604225C

PE Title: Theater Missile Defense (U)

Project Number: 3211  
Budget Activity: 04/05  
Dem/Val/EMD (U)  
February 1994

D. (U) WORK PERFORMED BY:

- 0 ESC - Hanscom AFB, MA
- 0 Sencom Inc, Mitre Corp - Bedford, MA
- 0 CAS - Huntsville, AL
- 0 PEO-TD - Huntsville, AL
- 0 ACC - Langley AFB, VA
- 0 AIA - Kelly AFB, TX

E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

- 1. TECHNICAL CHANGES: None
- 2. SCHEDULE CHANGES: None
- 3. COST CHANGES: None

F. (U) PROGRAM DOCUMENTATION:

- 0 Monthly status and quarterly IPR/FPR reports
- 0 ADTOC Acquisition Plan

4Q/FY94

G. (U) RELATED ACTIVITIES:

- 0 1106 Sensor Studies and Experiments
- 0 1200 Interceptor Technology Demonstration
- 0 1501 Survivability
- 0 1502 Lethality and Target Hardening
- 0 2104 Ground Based Radar
- 0 2207 PATRIOT

PE No. 6.3  
PE No. 6.3  
PE No. 6.3  
PE No. 6.3  
PE No. 6.3/6.4/6.5  
PE No. 6.4/6.5

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## FY1994 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0604216C/0604225C

PE Title: Theater Missile Defense (U)

Project Number: 3211

Budget Activity: 04/05

Dem/Val/EMD (U)

February 1994

0	2209	ACES	PE No. 6.3
0	2210	THAAD	PE No. 6.4/6.5
0	2212	Corps SAM	PE No. 6.3/6.4/6.5
0	3201	Architecture Studies	PE No. 6.3
0	3203	Intelligence Threat	PE No. 6.3
0	3300	Test and Evaluation Support	PE No. 6.3

There is no unnecessary duplication of effort within BMD0 or the DoD.

H. (U) OTHER APPROPRIATION FUNDS: Procurement FY1997 \$51.320; FY1998 \$67.710

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: FRG-US Air Defense Memorandum of Agreement (MOA)

J. (U) MILESTONE SCHEDULE:

0	ADTOC acquisition strategy completed	1Q/FY93
0	TMD message standards approved by Joint Integration	4Q/FY93
0	Engineering Organization (JIEO)	1Q/FY94
0	AF C <sup>2</sup> TMD C <sup>2</sup> definition	2Q/FY94
0	TADIL J messages updated	3Q/FY94
0	AOC/CRC TMD Information Plan	3Q/FY94
0	Technical Interface Design Plan (TIDP) updated	3Q/FY94
0	Gateway Implementation Plan	3Q/FY94
0	TMD message standard approved by CCB	3Q/FY94
0	TMD wargame	3Q/FY94
0	TIBS correlation algorithm	4Q/FY94
0	TMD message standard approved by NATO	4Q/FY94
0	TMD wargame	4Q/FY95

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## FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C/0603217C/0603218C/0604216C

PE Title: Theater Missile Defense/Ballistic Missile Defense (U)

Project Number: 3300  
Budget Activity: 03/04/06  
Adv Tech Dev/Dem/Val/  
Management Support (U)  
February 1994

### A. (U) RESOURCES: (\$ in Thousands)

#### Project Title: Test & Evaluation Support

Program Name:	FY1993 Actual	FY1994 Estimate	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	Total Program
0603216C RDT&E	62,552	91,748	163,855	167,900	169,682	203,882	208,582	Continuing
0603217C RDT&E	368,723	186,741	103,097	83,478	83,478	83,478	83,478	Continuing
0603218C RDT&E	13,270	0	0	0	0	0	0	Continuing
0604216C RDT&E	21,700	37,952	34,850	37,510	24,870	0	0	Continuing

### B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) This effort provides for BMDO planning oversight and coordination of integrated Test and Evaluation activities and inter-element, as well as inter-service Test and Evaluation efforts. Provides Independent Test Evaluation of systems, technology programs and special reviews. Provides for test infrastructure including: The National Test Facility; The Advanced Research Center; Simulation Center; common National Test Bed support; common ground test facilities; high fidelity models and simulation to support system development testing and evaluations including international cooperative with the United Kingdom, France, Israel, and the SHAPE Technical Center (STC); common range support, range upgrades; special test equipment and range instrumentation; Targets, test support assets; and test data documentation, management and storage facilities. Using mobile test assets such as the Airborne Surveillance Testbed (AST), provide critical signature and functional data essential to risk reduction and design of future optical surveillance systems.

(U) This project includes funding in FY93 and FY95 for 3312 and funding in FY93 and FY94 for 3308. Project 3314 is funded in FY93 and FY94 and funding for Operational Testing (3314) in the outyears will be transferred from Program funding lines to 3314 for execution. The following projects are funded in

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C/0603217C/0603218C/0604216C

PE Title: Theater Missile Defense/Ballistic Missile Defense (U)

Project Number: 3300  
Budget Activity: 03/04/06  
Adv Tech Dev/Dem/Val/  
Management Support (U)  
February 1994

FY93-FY95: 3301, 3302, 3303, 3304, 3305, 3306, 3307, 3309, 3310, 3311, 3313, and 3314. This CDS also provides for the development of the TMD System Exerciser. This integration tool will assist in performing system level interoperability testing.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1993 Accomplishments:

- o (\$ 46.722M) Successfully completed the Integrated System Test Capability Proof of Principle development phase; restructured and combined the functions of the Test Data Centers while continuing to receive, store and analyze test data.
- o (\$ 4.390M) Established BMD Independent Evaluation program and provided OT&E support.
- o (\$ 60.661M) Provided test resource support including advance scene generation for AIT, SHARP, INETS, MISTI, and SIT, range safety support for Theater Countermeasures Mitigation Program (1A & 1B), provided airborne optical data collection, and range infrastructure support, continued studies, analysis and planning to support selection of TMD range option(s), funded termination of USNS Redstone support.
- o (\$154.528M) Completed two STARS missions, continued development of TMD targets including test flights.
- o (\$113.042M) Transferred the National Test Facility executive services responsibilities to US AFSPACCOM and provided infrastructure support to NTF/ARC.
- o (\$ 37.780M) Provided critical functional and infrared electro-optical data and analysis from 5 BMDO sponsored flight experiments using the Airborne Surveillance Testbed.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C/0603217C/0603218C/0604216C  
 PE Title: Theater Missile Defense/Ballistic Missile Defense (U)

Project Number: 3300  
 Budget Activity: 03/04/06  
 Adv Tech Dev/Dem/Val/  
 Management Support (U)  
 February 1994

o (\$ 49.122M) Completed Build I of the High Fidelity BMD System level Simulation and rebaselined the Extended Air Defense Test Bed Development program, and initiated cooperative agreements with France and Shape Technical Center.

(U) FY 1994 Plans:

- o (\$ 22.700M) Complete global environment for proof of principle demonstration of the Distributed Theater Missile Defense System Level Exerciser and merge BMD BMC3 with ISIC global environment; conduct Proof of Principle demonstration for TMD System Exerciser; provide restructured Data Centers to receive, store, and analyze BMD test data.
- o (\$ 6.389M) Conduct BMD Evaluation Program including OT&E support.
- o (\$ 41.260M) Provide resource support for BMD0 testing including; deployment of Rapid Optical Beam Steering (ROBS) system to WSMR, completion of IOC at Center for Research Support (CERES), selection of option(s) and initiation of work to establish range capability to support TMD testing, collection of optical data in support of testing and sensor development, provide ground facilities. (\$118.400M) Provide STORM and HERA targets, facilities, and resources to support THAAD, PATRIOT, and ERINT flight test programs; complete STARS ODES demonstration flight.
- o (\$ 78.000M) Provide Infrastructure support to National Test Bed to include NTF and ARC/SC.
- o (\$ 22.000M) Provide airborne sensor support to gather electro-optical data and demonstrate critical optical sensor and system functions on TMD and NMD technology flight experiments using the Airborne Surveillance Testbed (AST).
- o (\$ 27.692M) Complete EADTB integration testing and software acceptance for initial operations capability, complete hardware installations of the STC node of the EADTB, and continue to support annual CINC experiments program with EADSIM. Document L2SS for future use and shut down.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C/0603217C/0603218C/0604216C

PE Title: Theater Missile Defense/Ballistic Missile Defense (U)

Project Number: 3300  
Budget Activity: 03/04/06  
Adv Tech Dev/Dem/Val/  
Management Support (U)  
February 1994

(U) FY 1995 Plans:

- o (\$ 31.300M) Develop interface for TMD System Exerciser; conduct TMD system level interoperability testing with System Exerciser; complete System Exerciser Environment for BMD integration in ISTC environment; provide Data Center support to receive, store, and analyze BMDO test data.
- o (\$ 7.000M) Conduct BMDO evaluation program including OT&E program
- o (\$ 55.560M) Provide test resources including range instrumentation, range development, infrastructure support, optical data collection, ground test facilities.
- o (\$100.100M) Provide targets, target facilities, and target resources to support BMDO flight testing.
- o (\$ 55.000M) Provide Infrastructure support to National Test Bed to include NTF and ARC/SC.
- o (\$ 22.000M) Provide airborne sensor support to gather electro-optical data and demonstrate critical optical sensor and system functions on TMD and NMD technology flight experiments using the Airborne Surveillance Testbed (AST).
- o (\$ 30.400M) Complete software development and testing for EADTB FOC, and complete verification, validation and accreditation of EADSIM and EADTB.

(U) Program Plan to Completion: This is a continuing program.

D. (U) WORK PERFORMED BY:

- o U.S. Army Space and Strategic Defense Command, Huntsville, AL
- o USAF Phillips Laboratory, Albuquerque, NM
- o USAF Arnold Engineering Development Center, Tullahoma, TN
- o USAF Space Command, Colorado Springs, CO
- o National Test Facility, Falcon AFB, CO
- o Naval Research Laboratory, Washington, DC
- o Naval Sea Systems Command

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C/0603217C/0603218C/0604216C

PE Title: Theater Missile Defense/Ballistic Missile Defense (U)

Project Number: 3300  
Budget Activity: 03/04/06  
Adv Tech Dev/Dem/Val/  
Management Support (U)  
February 1994

- o MIT/Lincoln Labs, Boston, MA
- o John Hopkins Applied Physics Lab
- o Martin Marietta
- o Sandia National Laboratories, Albuquerque, NM

E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

1. TECHNICAL CHANGES: Emphasis has shifted from an NMD (Strategic) focus to a TMD focus, based upon the outcome of the Bottom Up Review
2. SCHEDULE CHANGES: Previously this work was distributed among multiple associated/related PMAs. Support for NMD activities have been delayed or deleted. TMD activities have been programmed consistent with program schedules.
3. COST CHANGES: Previously this work was distributed among multiple associated/related PMAs. Major reductions have been made in the T&E cost associated with NMD, a FY95-FY99 reduction of \$1,168M. TMD T&E costs have increased to support increased TMD programs.

F. (U) PROGRAM DOCUMENTATION:

- o Programmatic status reports
- o Technical/Mission reports for analysis, assessment, and review tasks
- o BMD Directive 3240, 5000, 5000.2
- o Targets Master Plan
- o Test and Evaluation Master Plan
- o Independent Evaluation Plan

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603216C/0603217C/0603218C/0604216C

PE Title: Theater Missile Defense/Ballistic Missile Defense (U)

Project Number: 3300  
Budget Activity: 03/04/06  
Adv Tech Dev/Dem/Val/  
Management Support (U)  
February 1994

G. (U) RELATED ACTIVITIES: All BMD0 sponsored data collection, experiments, tests, high fidelity modeling, and simulation efforts.

H. (U) OTHER APPROPRIATION FUNDS: None

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS:

- o Memorandum of Agreement (MOA) between BMD0 and Israeli Ministry of Defense (MOD)
- o Letter of Agreement (LOA) between SSDC and UK MOD
- o Contract between SSDC and Israeli MOD

J. (U) MILESTONE SCHEDULE:

- o TMD System Exerciser POP Build 3Q/1994
- o Complete System Evaluation Plan 3Q/1994
- o Initial Operational Capability ROBS 4Q/1994
- o EADTB IOC 4Q/1994
- o Multiple PATRIOT/ERINT target launches/tests FY 1994
- o MSX Targets 1Q/1995
- o Multiple PATRIOT/THAAD/Navy Lower Tier target launches/tests FY 1995
- o Range support for TCMF FY 1995
- o TMD System Exerciser FY 1996

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Elements: 0603216C/0603217C/0603218C

Project Number: 4000  
Budget Activity: 03/06  
Adv Technology Dev/  
Management Support (U)  
February 1994

PE Titles: Theater Missile Defense/Ballistic Missile Defense (U)

A. (U) RESOURCES: (\$ in Thousands)  
Project Title: Operational Support

Program Name:	FY1993 Actual	FY1994 Estimate	FY1995 Estimate	FY1996 Estimate	FY1997 Estimate	FY1998 Estimate	FY1999 Estimate	Total Program
0603216C RDT&E	4,322	11,026	7,834	17,805	25,312	35,052	38,071	Continuing
0603217C RDT&E	89,557	43,360	47,996	47,581	38,563	32,328	31,476	Continuing
0603218C RDT&E	205,082	198,802	215,233	223,077	226,077	229,074	232,111	Continuing

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) This project provides program management, system engineering, and program control support common to all other projects within these PEs. Program management tasks include BMD0 and Executing Agent central management functions, including those that support the Office of the Director, Strategic Defense Initiative and his supporting staff located within the Pentagon. Typical system engineering tasks include review and analysis of technical project design, development and testing, test planning, assessment of technology maturity and technology integration across BMD0 projects; and support of design reviews and technology inter-face meetings. Program control tasks include assessment of schedule, cost, and performance, with attendant documentation of the many related programmatic issues. This project supports funding for personnel and expenses for travel (TDY), training, rents, communications, information management, utilities, printing, reproduction, supplies, and equipment.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Elements: 0603216C/0603217C/0603218C

PE Titles: Theater Missile Defense/Ballistic Missile Defense (U)

Project Number: 4000  
Budget Activity: 03/06  
Adv Technology Dev/  
Management Support (U)  
February 1994

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1993 Through FY 1999 Plans:

o The funding provided by this project has enabled and will enable the executing agents to centralize funding and management of common and recurring operating costs. This optimizes their value across the entire range of BMDO projects, and allows technical research funding to be devoted solely toward that purpose. This strategy of centralizing management will continue to occur throughout this program.

D. (U) WORK PERFORMED BY: The System Engineering and Program Control tasks are performed through a number of support contracts, and civilian program managers as employees of the Army Strategic Defense Command (Huntsville AL and Crystal City VA) and the Air Force. Work is performed by the following major contractors:

- o Ford Aerospace Division - Los Angeles, CA (AF)
- o ANSER Inc. - Los Angeles, CA (AF)
- o COLSA Inc. - Huntsville, AL (Army)
- o GRC Inc. - Huntsville, AL (Army)
- o Hewlett Packard - Huntsville, AL (Army)

E. (U) PROGRAM DOCUMENTATION:

- o Programmatic Status Reports
- o Technical Reports for Analysis, Assessment, Review Tasks

F. (U) RELATED ACTIVITIES: This project supports all other BMDO projects within these PEs. There is no unnecessary duplication of effort within BMDO or the DoD.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Elements: 0603216C/0603217C/0603218C

PE Titles: Theater Missile Defense/Ballistic Missile Defense (U)

Project Number: 4000  
Budget Activity: 03/06  
Adv Technology Dev/  
Management Support (U)  
February 1994

G. (U) OTHER APPROPRIATION FUNDS: None

H. (U) MILESTONE SCHEDULE:

- o Products are generated on an as-required basis in support of the BMDO technology and management projects.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 4302  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

A. (U) RESOURCES: (\$ in Thousands)  
Project Title: Technology Transfer

	FY1993	FY1994	FY1995	FY1996	FY1997	FY1998	FY1999	Total
<u>Program Name:</u>	<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Program</u>
0603217C RDT&E	2,239	2,862	2,862	2,862	2,862	2,862	2,862	Continuing

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENTS AND SYSTEM CAPABILITIES:

(U) The Technology Applications Program was established in 1986 to make BMD technology available to federal agencies, state and local governments, and U.S. business and research interests. The objective of this program is to develop and support the transfer of BMD-derived technology to Department of Defense applications as well as to other federal, state, and local government agencies, federal laboratories, universities, and the domestic private sector.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

C. (U) PROGRAM ACCOMPLISHMENT AND PLANS:

(U) FY 1993 Accomplishments:

o Continue to make BMD technology available to federal agencies, state and local governments, and U.S. business and research interests. Additional meetings with private and federal technology transfer specialists to review BMD technology for potential application in biomedical research; electronics, communications, and computer technology, power generation, storage, and transmission; and materials and industrial processes. The Joint BMD-Defense Technology Applications effort

U N C L A S S I F I E D

U N C L A S S I F I E D

FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 4302  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

- o continue to be emphasized through the use of technology briefs to Army, Navy, and Air Force laboratories and research centers.
- o (\$960K) Database - Maintain up to date information on potential BMD programs that have commercial applications. This is a National Data Base on BMD programs accessed by 21,000 users.
- o (\$350K) Panel Reviews - Provide assistance to large medium and small businesses wishing to bring BMD supported technology to the commercial market.
- o (\$300K) Outreach - Publications, brochures, target articles for journals and news papers, quarterly newsletters, conference exhibits, ads and reports on BMDO technology, etc.
- o (\$270K) Networking - Federal Agencies and Laboratories, Professional Societies, Trade Associations, State, Federal, Local and Regional programs. Industry, Universities, and International BMD contractors and interested parties.
- o (\$359K) Demonstration Projects - Industry, State and local Governments, Universities and other Federal agencies.

(U) FY 1994 Plans:

- o Efforts will continue to emphasize the technology transfer programs begun in earlier years. BMD technology will continue to be reviewed for inclusion into the Technology Applications Information System computer database. Additional technology transfer initiatives will be undertaken as opportunities become available. Continue demonstration programs that will assist BMDO in expediting potential technology to the private sector. Develop close interaction working relationship with the National Technology Transfer Center so as to leverage their capabilities in the performance of our mission.
- o (\$1.200K) Database - Maintain up to date information on potential BMD programs that have commercial applications. This is a National Data Base on BMD programs accessed by 21,000 users.
- o (\$450K) Panel Reviews - Provide assistance to large medium and small businesses wishing to bring BMD supported technology to the commercial market.
- o (\$350K) Outreach - Publications, brochures, target articles for journals and news papers, quarterly newsletters, conference exhibits, ads and reports on BMDO technology, etc.

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U N C L A S S I F I E D

FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 4302  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

- o (\$350K) Networking - Federal Agencies and Laboratories, Professional Societies, Trade Associations, State, Federal, Local and Regional programs. Industry, Universities, and International BMD contractors and interested parties.
- o (\$512K) Demonstration Projects - Industry, State and Local Governments, Universities and other Federal agencies.

(U) FY 1995 Plans:

- o Program will continue as mandated by law with minor changes to preceeding FY94 effort.
- o (\$1.200K) Database - Maintain up to date information on potential BMD programs that have commercial applications. This is a National Data Base on BMD programs accessed by 21,000 users.
- o (\$450K) Panel Reviews - Provide assistance to large medium and small businesses wishing to bring BMD supported technology to the commercial market.
- o (\$350K) Outreach - Publications, brochures, target articles for journals and news papers, quarterly newsletters, conference exhibits, ads and reports on BMDO technology, etc.
- o (\$350K) Networking - Federal Agencies and Laboratories, Professional Societies, Trade Associations, State, Federal, Local and Regional programs. Industry, Universities, and International BMD contractors and interested parties.
- o (\$512K) Demonstration Projects - Industry, State and Local Governments, Universities and other Federal agencies.
- o Program will continue as mandated by law with minor changes to preceeding FY94 effort.

(U) Program Plan to Completion: This is a continuing program.

D. (U) WORK PERFORMED BY:  
o NASA

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U N C L A S S I F I E D

FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 4302  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

E. (U) COMPARISON WITH FY 1994 DESCRIPTIVE SUMMARY:

1. TECHNICAL CHANGES:

2. SCHEDULE CHANGES:

3. COST CHANGES:

F. (U) PROGRAM DOCUMENTATION: N/A (ongoing)

G. (U) RELATED ACTIVITIES:

(U) May be related potentially to all BMDO programs. There is no unnecessary duplication of effort within BMDO or the DoD.

H. (U) OTHER APPROPRIATION FUNDS: None

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None

J. (U) MILESTONE SCHEDULE:

o	Report on successful technology transfer models	2Q/FY94
o	Conduct five Technology Applications Reviews	2Q/FY94
o	Publish BMD High Technology Update (quarterly)	1Q, 2Q, 3Q, 4Q/FY94
o	Publish 1993 BMD Technology Applications Report	1Q/FY94

U N C L A S S I F I E D

FY1995 RDT&E DESCRIPTIVE SUMMARY

Program Element: 0603217C

PE Title: Ballistic Missile Defense (U)

Project Number: 4305  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

A. (U) RESOURCES: (\$ in Thousands)  
Project Title: Miniaturized Accelerators for PET

Program Name:	FY1993	FY1994	FY1995	FY1996	FY1997	FY1998	FY1999	Total
0603217C RDT&E	Actual	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Program
	500	0	0	0	0	0	0	Completed

B. (U) BRIEF DESCRIPTION OF MISSION REQUIREMENT AND SYSTEM CAPABILITIES:

(U) The Positron Emission Tomography (PET) accelerator program, initiated in FY88 by Congressional direction, is a research project that will reduce the size, weight, and cost of current particle accelerators used to develop radio-pharmaceuticals for Positron Emission Tomography medical diagnoses.

(U) This project is assigned to the Budget Activity and Program Element codes as identified in this descriptive summary in accordance with existing Department of Defense policy. Further justification of the Budget Activity code assigned to each Program Element is contained within the Brief Description of Element section of each Program Element Summary.

C. (U) PROGRAM ACCOMPLISHMENTS AND PLANS:

(U) FY 1993 Accomplishments:

o (500K) Complete the final phase of PET accelerator research, and development of radio-pharmaceuticals for use in Positron Emission Tomography medical diagnoses by demonstrating the systems in a Government clinical environment. Demonstrate a mobile concept to support several users.

(U) FY 1994 Plans: Program Terminated in FY93.

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FY1995 RDT&E DESCRIPTIVE SUMMARY

Project Number: 4305  
Budget Activity: 03  
Adv Technology Dev (U)  
February 1994

Program Element: 0603217C  
PE Title: Ballistic Missile Defense (U)

(U) FY 1995 Plans: None

D. (U) WORK PERFORMED BY:

(U) PET Accelerator Program:  
o Science Research Laboratory Inc. - Somerville, MA  
o Science Applications International Corporation - San Diego, CA

E. (U) COMPARISON WITH FY 1993 DESCRIPTIVE SUMMARY:

1. TECHNICAL CHANGES: None
2. SCHEDULE CHANGES: None
3. COST CHANGES: Remaining funds will be forwarded to SRL to complete field test.

F. (U) PROGRAM DOCUMENTATION: Program Management Agreement S4305, PET.

G. (U) RELATED ACTIVITIES:

There is no unnecessary duplication of effort within the BMDO or DoD.

H. (U) OTHER APPROPRIATION FUNDS: None.

I. (U) INTERNATIONAL COOPERATIVE AGREEMENTS: None.

J. (U) MILESTONE SCHEDULE:

- o Complete research on PET as congressionally mandated in FY93.

U N C L A S S I F I E D

## **BMDO PROCUREMENT ANNEX**

U N C L A S S I F I E D

BALLISTIC MISSILE DEFENSE ORGANIZATION  
PROCUREMENT JUSTIFICATION

Justification of Procurement Funds

Exhibit P-1 Procurement Summary

Patriot Exhibits

Hawk Exhibits

Sea Based TMD Exhibits

U N C L A S S I F I E D



U N C L A S S I F I E D

PROCUREMENT, DEFENSEWIDE

	<u>\$ in Thousands</u>
FY 1995 Estimate	\$273,390
FY 1994 Estimate	\$120,719
FY 1993 Actual	\$ 75,200

Ballistic Missile Defense Organization

Purpose and Scope of Work

These funds provide for the purchase of the latest technologically advanced systems for locating, identifying, tracking, and destroying ground launched ballistic missiles.

Justification of Funds

The FY 1995 (\$273,390 thousand) funding is for the Patriot Missile system, the USMC HAWK system, and the Sea-Based Theater Missile Defense Initiative.

The PATRIOT PAC-3 Missile provides an autonomous firing capability, enhanced Electronic Counter Countermeasure capabilities, and improved performance against low Radar Cross Section targets, both aircraft and tactical missiles. The missile will expand the limited asset defense capability of the PATRIOT PAC-2 program by incorporating an active seeker into the PATRIOT Missile. The program includes funds for Radar Enhancements, Missile Enhancements, Remote Launch, Communications Upgrades, and technical support costs.

The USMC HAWK funding will upgrade the USMC HAWK system to provide for a Tactical Ballistic Missile Defense capability. This will include a Battery Command Post (BCP) upgrade, improved lethality missile upgrades, missile fuze modifications, north finding modules, and air defense communication platforms.

The Sea-Based Theater Missile Defense Initiative provides support equipment, training, equipment, and simulation capabilities for shore based facilities and for advance planning, design, cost, and feasibility studies and ship integration impact to support the introduction and integration of Theater Air Defense (TAD) capabilities in AEGIS cruiser (CG47) and destroyer (DDG51) class ships.

U N C L A S S I F I E D

U N C L A S S I F I E D

BALLISTIC MISSILE DEFENSE ORGANIZATION

FY 1995 PRESIDENT'S BUDGET SUBMISSION

APPROPRIATION: 0300 D PROCUREMENT, DEFENSEWIDE

Exhibit P-1

FEBRUARY 1994

Millions of Dollars

<u>Line</u> <u>No.</u>	<u>Nomenclature</u>	<u>Ident</u> <u>Code</u>	<u>FY 1993</u> <u>Quantity</u> <u>Cost</u>	<u>FY 1994</u> <u>Quantity</u> <u>Cost</u>	<u>FY 1995</u> <u>Quantity</u> <u>Cost</u>
BUDGET ACTIVITY 1: MAJOR EQUIPMENT					
PATRIOT		--	75.200	120.719	255.063
USMC HAWK		--	0	0	3.831
Sea Based TMD Initiative		--	0	0	14.496
Total		--	75.200	120.719	273.390

U N C L A S S I F I E D

REPORTS CONTROL SYMBOL DD-COMP (AR) 1092		BUDGET ITEM JUSTIFICATION SHEET				DATE FEBRUARY 1994	
APPROPRIATION/BUDGET ACTIVITY PROCUREMENT, DEFENSEWIDE/ACTIVITY 1		P-1 ITEM NOMENCLATURE TMD - PATRIOT					
	FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99
QUANTITY	N/A	N/A	N/A	220	330	330	330
COST IN MIL	75.2	120.7	255.1	435.6	386.5	470.6	439.9
<p>DESCRIPTION: The PAC-3 Missile provides an autonomous firing capability, enhanced Electronic Counter Countermeasure capabilities, and improved performance against low Radar Cross Section targets, both aircraft and tactical missiles. The missile will expand the limited asset defense capability of the PATRIOT PAC-2 program by incorporating an active seeker into the PATRIOT Missile. These changes are needed to counter Tactical Ballistic Missile with low radar cross section, high terminal velocity and high angle of attack. Modification to PATRIOT radar in support of TMD that will increase PATRIOT effectivity, survivability, flexibility of defense design, footprint and detection of smaller low radar cross section targets.</p> <p>JUSTIFICATION: The FY 93-99 program includes funds for Radar Enhancements, Missile Enhancements, Remote Launch, Communication Upgrades, and technical support costs.</p>							
P-1 SHOPP LIST NO.		PAGE NO.		1 OF 3		EXHIBIT P-40	

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## MISSILE COMPONENT COST BREAKDOWN

EXHIBIT P-12

PROCUREMENT APPROPRIATION /1

MISSILE SYSTEM: TMD-PATRIOT PRIME CONTRACTOR: RAYTHEON

SYSTEM/ITEM BREAKDOWN	FY 93			FY 94			FY 95		
	QTY	UNIT COST	TOTAL	QTY	UNIT COST	TOTAL	QTY	UNIT COST	TOTAL
MISSILE COMPONENTS									
AIRFRAME									
PROPULSION									
GUIDANCE AND CONTROL									
WARHEAD									
CANISTER									
MISSILE ENHANCEMENT (QRP)	180	0.030	5.4						
SUBTOTAL			5.4						
GROUND SUPPORT EQUIPMENT COMPONENTS									
SUBTOTAL									
TOTAL MISSILE & GSE			5.4						
OTHER COSTS									
CONTRACTOR ENGINEERING			16.7			29.9			28.5
GOVERNMENT ENGINEERING			8.0			26.7			22.2
INTEGRATED LOGISTICS SUPPORT			5.6			12.5			13.2
SOFTWARE SUPPORT			10.7			23.2			21.6
NAMSA									5.7
FIELDING									5.0
IPF (TOOL & TEST)			7.3			5.2			6.7
DMPE			0.5			2.0			4.8
GROSS WEAPON SYSTEM COST			48.8			99.5			107.7
SUBTOTAL			54.2			99.5			107.7
NET P-1 COST - ACTIVITY 2			54.2			99.5			107.7
MODS - ACTIVITY 3			21.0			21.2			147.4
TOTAL PROGRAM COSTS			75.2			120.7			255.1

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BUDGET PROCUREMENT HISTORY AND PLANNING							DATE	FEBRUARY 1994		
APPROPRIATION/BUDGET ACTIVITY PROCUREMENT, DEFENSEWIDE /ACTIVITY 1			P-1 ITEM NOMENCLATURE TMD (PATRIOT)							
LINE ITEM/FISCAL YEAR	CONTRACTOR	CONTRACT METHOD AND TYPE	CONTR BY	AWARD DATE	DATE OF FIRST DELIVERY	QTY	UNIT COST	SPECS AVAIL NOW	SPEC REV REQD	IF YES WHEN AVAIL
REMARKS:										

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REPORTS CONTROL SYMBOL DD-COMP (AR) 1092		BUDGET ITEM JUSTIFICATION SHEET				DATE FEBRUARY 1994	
APPROPRIATION/BUDGET ACTIVITY MISSILE PROCUREMENT ARMY/ACTIVITY 1		P-1 ITEM NOMENCLATURE TMD - PATRIOT					
	FY 93	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99
QUANTITY	N/A	N/A	N/A	N/A	N/A	N/A	N/A
COST IN MIL	21.0	21.2	147.4	161.3	129.1	0.0	0.0
<p>DESCRIPTION: Modification to PATRIOT radar in support of TMD that will increase PATRIOT effectivity, survivability, flexibility of defense design, footprint and detection of smaller low radar cross section targets. Modification of the launcher for increased survivability, reload, and to support the incorporation of the ERINT missile, and communication upgrades.</p> <p>JUSTIFICATION: The funds in FY92-99 are to provide lower cross section radar capability, communication upgrades, and Remote Launch capability.</p>							
MODIFICATION Radar Enhancements (QRP) Communication Upgrade Phase I Radar Phase III with HRR		FIRST PROCUREMENT YEAR FY92 FY94 FY95					
P-1 SHOPP LIST NO.	PAGE		NO.		1 OF 9		EXHIBIT P-40

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FEBRUARY 1994

MATERIEL CHANGE  
TMD - PATRIOT Weapon Systems Modification-Procurement Dollar Summary  
\$ IN MILLIONS

SYSTEM/MODIFICATION	<u>FY 93</u>	<u>FY 94</u>	<u>FY 95</u>
RADAR ENHANCEMENTS (QRP)	21.0	14.0	
COMMO UPGRADE PH I		7.2	23.8
RADAR PHASE III W/HRR			123.6
TOTAL	<u>21.0</u>	<u>21.2</u>	<u>147.4</u>

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MODIFICATION INSTALLATION SUMMARY  
PATRIOT Weapon Systems Modification

FEBRUARY 1994

(TOA, DOLLARS IN MILLIONS)

SYSTEM/MODIFICATION	<u>FY93</u>	<u>FY94</u>	<u>FY95</u>	<u>FY96</u>	<u>FY97</u>	<u>FY98</u>	<u>FY99</u>	<u>TOTAL</u>
RADAR ENHANCEMENTS (QRP)	2.0	0.7	0.0	0.0	0.0	0.0	0.0	2.7
COMMO UPGRADE PH I	0.0	0.3	1.1	0.7	0.0	0.0	0.0	2.1
RADAR PHASE III W/HRR	0.0	0.0	5.9	4.0	4.2	0.0	0.0	14.1
TOTAL	2.0	1.0	7.0	4.7	4.2	0.0	0.0	18.9

P1 Shopping List No.

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MODIFICATION OF TMD (PATRIOT) WEAPON SYSTEM

FEBRUARY 1994

MODIFICATION: RADAR ENHANCEMENT (QUICK RESPONSE PROGRAM) (1-91-03-1234)

DESCRIPTION/JUSTIFICATION

This task has the objective of improving PATRIOT's survivability and war fighting capabilities by incorporating enhancements into the Radar Set (RS) receiver. Overall benefits include a reduction in receiver noise and antenna sidelobe levels. These improvements will be accompanied by changes to the hardware in the Radar Set (AN/MPQ-53).

DEVELOPMENT STATUS:

<u>MILESTONES</u>		<u>PLANNED</u>	<u>ACCOMPLISHED</u>					
FINANCIAL PLAN	Preliminary Design Review (PDR)	4QFY91	4QFY91	TOTAL				
	Critical Design Review (CDR)	1QFY92	1QFY92					
	Contractor Test and Evaluation (CTE)	2QFY92	2QFY92					
	Development Test and Evaluation (DTE)	2QFY92	3QFY92					
	Initial Operational Test and Evaluation (IOTE)	4QFY93	4QFY93					
	FY93 & PRIOR	FY94	FY95	FY96	FY97	FY98	FY99	TO COMP

RDT&E FUNDING PROVIDED BY FY91 ARMY SUPPLEMENTAL

RADAR ENHANCEMENT (QUICK RESPONSE PROGRAM) (1-91-03-1234)

P-1 SHOPP LINE NO.

EXHIBIT P-3A  
PAGE 4 OF 9

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	FY93 & PRIOR	FY94	FY95	FY96	FY97	FY98	FY99	TO COMP TOTAL
--	--------------	------	------	------	------	------	------	------------------

**METHOD OF IMPLEMENTATION:** The modification will be applied in kit form by contractor field teams in conjunction with scheduled CONUS and OCONUS Sweepdowns. 12 months lead time. Includes spares requirement.

## INSTALLATION SCHEDULE

[illegible]

**EXHIBIT P-3A**  
**PAGE 5 OF 9**

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MODIFICATION OF TMD (PATRIOT) WEAPON SYSTEM

FEBRUARY 1994

MODIFICATION: COMMUNICATION UPGRADE PHASE I (1-92-03-1237)

DESCRIPTION/JUSTIFICATION

The communication upgrades includes the Routing Logic Radio Interface Unit Upgrade (RLRIU-U) and Joint Tactical Information Distribution System/Mobile Subscriber Equipment (JTIDS/MSE).

The Routing Logic Radio Interface Unit Upgrade (RLRIU-U) will replace the present RLRIU because of incompatibilities with the Mobile Subscriber Equipment (MSE). Advantage of the RLRIU-U include MSE capability, the ability to interface with the Joint Tactical Information Distribution System (JTIDS) terminals, provide synchronous digital outputs and has interfaces for remote sensors. The RLRIU-U will also allow a greater bandwidth which provides increased throughput.

DEVELOPMENT STATUS:

This modification provides for an upgrade to the Interface between the EWCC and other communication subsystems. Contract award is scheduled for Nov 92.

MLESTONES

PLANNED

ACCOMPLISHED

Preliminary Design Review

1QFY93

3QFY93

Critical Design Review

3QFY93

4QFY93

Contractor Test and Evaluation

2QFY94

Development Test and Evaluation

1QFY95

Initial Operational Test and Evaluation

4QFY95

FINANCIAL PLAN:

FY93 & PRIOR    FY94    FY95    FY96    FY97    FY98    FY99    TOTAL

RDTE FUNDING BEING PROVIDED BY DEPT. ARMY

COMMUNICATION UPGRADE PHASE I (1-92-03-1237)

P-1 SHOPP LINE NO.

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PAGE 8 OF 9

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TO

FY93 & PRIOR	FY94	FY95	FY96	FY97	FY98	FY99	COMP	TOTAL
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## PROCUREMENTS

KIT QUANTITY								
INSTALLATION KITS	3	11	7					21

INSTALLATION KITS (NON-RECURRING)								
INSTALLED EQUIP	6.9	22.7	14.7					44.3
INSTALLED EQUIP (NON-RECURRING)								
ENG CHANGE ORDERS								
DATA								
INSTALLATION	0.3	1.1	0.7					2.1
TOTAL (PROC COST)	7.2	23.8	15.4					46.4

METHOD OF IMPLEMENTATION: This modification will be applied in kit form by contractor field teams in conjunction with scheduled CONUS and OCONUS Sweepdowns. 12 months lead time. Includes spares requirement.

CONTRACT DATE:								
PROD DELIV DATE:	FY93	JUN 94	FY95	OCT 94	FY96	OCT 95		
	FY93	JUN 95	FY95	OCT 95	FY96	OCT 96		

## INSTALLATION SCHEDULE

1	FY 94	4	FY 95	4	FY 96	4	FY 97	4
	2	3	2	3	2	3	2	3

INPUT FY94  
FY95  
FY96

1	FY 94	4	FY 95	4	FY 96	4	FY 97	4
	2	3	2	3	2	3	2	3

OUTPUT FY94  
FY95  
FY96

1	FY 94	4	FY 95	4	FY 96	4	FY 97	4
	2	3	2	3	2	3	2	3

COMMUNICATION UPGRADE PHASE I (1-92-03-1237)  
P-1 SHOPP LINE NO.

# MODIFICATION OF TMD (PATRIOT) WEAPON SYSTEM

**MODIFICATION:** RADAR PHASE III WITH HRR

## DESCRIPTION/JUSTIFICATION

The objective of this modification is to increase the average power providing greater multifunction capability and increase the reliability and maintainability of the radar. Transmitter and receiver modifications will be made to the radar.

**DEVELOPMENT STATUS:**

<u>MILESTONES</u>		<u>PLANNED</u>						<u>ACCOMPLISHED</u>
Preliminary Design Review		2QFY92					2QFY92	
Critical Design Review		3QFY93					3QFY93	
Contractor Test and Evaluation		3QFY94						
Development Test and Evaluation		2QFY95						
Initial Operational Test and Evaluation		3QFY95						
FY93 & PRIOR		FY94	FY95	FY96	FY97	FY98	FY99	TOTAL
RDT&E	61.2	33.4	26.4	20.4				141.4

RADAR PHASE III WITH HRR

**P-1 SHOPP LINE NO.**

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PROCUREMENTS

	FY93 & PRIOR	FY94	FY95	FY96	FY97	FY98	FY99	TO COMP TOTAL
--	--------------	------	------	------	------	------	------	------------------

KIT QUANTITY	38	24	26					88
INSTALLATION KITS								

INSTALLATION KITS (NON-RECURRING)								
INSTALLED EQUIP								
INSTALLED EQUIP (NON-RECURRING)								
ENG CHANGE ORDERS								
DATA								
INSTALLATION								
TOTAL (PROC COST)	117.7	80.3	83.4					281.4
	5.9	4.0	4.2					14.1
	123.6	84.3	87.6					295.5

METHOD OF IMPLEMENTATION: This modification will be applied in kit form by contractor field teams in conjunction with scheduled CONUS and OCONUS Sweepdowns. 22 months lead time.

CONTRACT DATE:	FY95	FEB 95	FY96	FEB 96	FY97	FEB 97	FY98	
PROD DELIV DATE:	FY95	MAR 97	FY96	MAR 98	FY97	MAR 99	FY98	

## INSTALLATION SCHEDULE

1	FY 2	97	4	1	2	98	4	1	2	99	4	
---	------	----	---	---	---	----	---	---	---	----	---	--

INPUT	FY95	9	10	10	9	6	6	6	6	7	7	6
	FY96											
	FY97											

1	FY 2	97	4	1	2	98	4	1	2	99	4	
---	------	----	---	---	---	----	---	---	---	----	---	--

OUTPUT	FY95	9	10	10	9	6	6	6	6	7	7	6
	FY96											
	FY97											

RADAR PHASE III WITH HRR  
P-1 SHOPP LINE NO.

UNCLASSIFIED

U N C L A S S I F I E D

BUDGET ITEM JUSTIFICATION SHEET										DATE	FEBRUARY 1994
APPROPRIATION/BUDGET ACTIVITY: PROCUREMENT, DEFENSEWIDE/BUDGET ACTIVITY <u>1</u>		P-1 ITEM NOMENCLATURE: HAWK MODIFICATIONS (TMD)								(RCN	)
QUANTITY	FY 1993	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000			
COST (IN MILLIONS)	\$ 0	\$ 0	\$ 3.831	\$ 5.131	\$20.530	\$ 0	\$ 0	\$ 0	\$ 0		
<p><b>DESCRIPTION:</b> This is a roll-up line to upgrade the USMC HAWK system to provide for a Tactical Ballistic Missile Defense capability.</p> <p><b>JUSTIFICATION:</b></p> <ol style="list-style-type: none"> <li>1) BCP UPGRADE: Procurement of modification kits to Upgrade the Battery Command Post (BCP) to accept Tactical Ballistic Missile (TBM) data from the Air Defense Communications Platform (ADCP) Hardware/Software to allow the HAWK to engage short range TBMs providing the USMC a point defense capability.</li> <li>2) IMPROVED LETHALITY MISSILE UPGRADES: Replacement of the current missile warhead and fuze is required to increase HAWK lethality against TBMs. These modification kits will be installed in the HAWK Missile.</li> <li>3) MISSILE FUZE MODIFICATIONS: An ECP to the current ILM fuze is required to further increase probability of kill against various various range TBMs.</li> <li>4) NORTH FINDING MODULES: This modification procures off-the-shelf north finding modules for improving the position locating capability for the HAWK TBM system.</li> <li>5) AIR DEFENSE COMMUNICATION PLATFORMS: Procurement of a communication platform for receipt, filtration, correlation and dissemination of sensor data for target acquisition purposes only.</li> </ol>											

U N C L A S S I F I E D

U N C L A S S I F I E D

MODIFICATION OF WEAPON SYSTEM										DATE FEBRUARY 1994
MODIFICATION TITLE: <u>MISSILE FUZE MODIFICATIONS</u>										
MODELS OF SYSTEMS AFFECTED: <u>HAWK MISSILE</u>										
DESCRIPTION/JUSTIFICATION: This modification is to the current ILM fuze to allow for increased probability of kill against various range TBMs.										
DEVELOPMENT STATUS/MAJOR DEVELOPMENT MILESTONES: ECP Approval: 3QFY94 Production: 1QFY95										
FINANCIAL PLAN: (\$ in millions) <u>FY 93/Prior</u> <u>FY 94</u> <u>FY 95</u> <u>FY 96</u> <u>FY 97</u> <u>FY 98</u> <u>FY 99</u> <u>TOTAL</u>										
RD&E \$ \$ \$ \$ \$ \$ \$ \$ \$										
PROCUREMENT:										
-Kit Quantity										
-Installation Kits Recurring				500						
-Installation Kit Nonrecurring				\$ .414						
-Installed Equipment Recurring				\$ .138						
-Installed Equipment Nonrecurring										
-Engineering Change Orders										
-Data										
-Training Equipment										
-Support Equipment										
Total Procurement Cost				\$ .552						
METHOD OF IMPLEMENTATION: (Circle One) <u>Depot Installed</u> <u>XX</u> <u>Contractor Installed</u>										
CONTRACT DATE: (MO/YR) <u>CY (FY95): OCT 94</u> <u>BY (FY96):</u> <u>BY (FY97):</u>										
PRODUCTION DELIVERY DATE: <u>CY (FY95): APR 95</u> <u>BY (FY96):</u> <u>BY (FY97):</u>										
INSTALLATION <u>FY 1993</u> <u>FY 1994</u> <u>FY 1995</u> <u>FY 1996</u> <u>FY 1997</u> <u>FY 1998</u>										
SCHEDULE: <u>1</u> <u>2</u> <u>3</u> <u>4</u> <u>1</u> <u>2</u> <u>3</u> <u>4</u> <u>1</u> <u>2</u> <u>3</u> <u>4</u> <u>1</u> <u>2</u> <u>3</u> <u>4</u>										
INPUT CY (FY93) <u>88 88 88 88 88 88 60</u>										
BY (FY94) <u>88 88 88 88 88 88 60</u>										
BY+1 (FY95) <u>88 88 88 88 88 88 60</u>										
OUTPUT 93/PRIOR <u>88 88 88 88 88 88 60</u>										
BY+1 (FY95) <u>88 88 88 88 88 88 60</u>										



U N C L A S S I F I E D

MODIFICATION OF WEAPON SYSTEM

DATE FEBRUARY 1994

MODIFICATION TITLE: BCP UPGRADE

MODELS OF SYSTEMS AFFECTED: BATTERY COMMAND POST (BCP) HAWK SYSTEM (ID #02626C)

DESCRIPTION/JUSTIFICATION: The modifications being made under this title are hardware and software changes in the existant fielded system which allow the BCP to accept TBM information from a sensor, process the information, and acquire the target TBM.

DEVELOPMENT STATUS/ CONTRACT AWARD: 2/93

MAJOR DEVELOPMENT MILESTONES: PRODUCTION 12/94-2/96

FINANCIAL PLAN: (\$ in millions) FY 93 FY 94 FY 95 FY 96 FY 97 FY 98 FY 99 TOTAL

RDT&E \$ \$ \$ \$ \$ \$ \$ \$

PROCUREMENT:

-Kit Quantity 12 13

-Installation Kits Recurring\* \$ \$

-Installation Kit Nonrecurring\* \$ \$

-Installed Equipment Recurring \$ 1.221 \$ 1.226

-Installed Equipment Nonrecurring \$ \$

-Engineering Change Orders \$ \$

-Data \$ \$

-Training Equipment \$ 0.104 \$ 0.103

-Support Equipment/Support Costs \$ 0.052 \$ 0.051

Total Procurement Cost \$ 1.377 \$ 1.380

METHOD OF IMPLEMENTATION: (Circle One) Depot Installed XX Contractor Installed

CONTRACT DATE: (MO/YR) Oct 94 FY 95 FY 96 FY 97 FY 98 FY 99 FY 1998

PRODUCTION DELIVERY DATE: Oct 95 FY 1995 FY 1996 FY 1997 FY 1998

INSTALLATION FY 1993 FY 1994 FY 1995 FY 1996 FY 1997 FY 1998

SCHEDULE: 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4

INPUT 92/PRIOR None Prior

CY (FY93)

BY (FY94)

BY+1(FY95)

OUTPUT 93/PRIOR

BY (FY93)

BY+1 (FY94)

\*Kits will be installed during Depot Master Work Schedule

U N C L A S S I F I E D

DATE FEBRUARY 1994

## DATE FEBRUARY 1994

**MODELS OF SYSTEMS AFFECTED: HAWK ILM MISSILES**

**MODELS OF SYSTEMS AFFECTED: HAWK ILM MISSILES**

**DESCRIPTION/JUSTIFICATION:** This modification upgrades the missile warhead to provide an increased probability of kill against various range TBMs.

DEVELOPMENT STATUS/MAJOR DEVELOPMENT MILESTONES:	ECP (ARMY) Approval	4thQTR 92	Procurement 1Qtr 95

FINANCIAL PLAN: (\$ in millions)	FY 93/prior	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	TO COMPL	TOTAL
RDT&E	\$ 0	\$	\$	\$	\$	\$	\$	\$	\$

**PROCUREMENT:**

-Kit Quantity

## -Installation Kits Recurring

## -Installation Kit Nonrecurring

## -Installed Equipment Recurring

-Installed Equipment Nonrecurring

## -Engineering Change Orders

**-Data**

## -Training Equipment

## -Support Equipment

Total Procurement Cost

METHOD OF IMPLEMENTATION: (Circle one)

CONTRACT DATE: (MO/YR) CY (FY95): OCT 94

PRODUCTION DELIVERY DATE:	CY (FY95):	APR 95
MANUFACTURE DATE:	WEEK 1000	WEEK 1001

## INSTALLATION

**SCHEDULE:**

INPUT	CY (FY93)	FY (FY04)
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7
8	8	8
9	9	9
10	10	10
11	11	11
12	12	12
13	13	13
14	14	14
15	15	15
16	16	16
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32	32	32
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41	41	41
42	42	42
43	43	43
44	44	44
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82	82	82
83	83	83
84	84	84
85	85	85
86	86	86
87	87	87
88	88	88
89	89	89
90	90	90
91	91	91
92	92	92
93	93	93
94	94	94
95	95	95
96	96	96
97	97	97
98	98	98
99	99	99
100	100	100

BY (FY94) (FY05)

BY+I (FY93)  
OUTFIT CY (FY03)

ICY (FY93)  
BY (FY04)

BY (F194) 19

\* Kits will be installed during missile rebuild/shelf life replacement master work schedule

EXHIBIT P-3A

ITEM NO. PAGE NO. 4 OF 4

FOR OFFICIAL USE ONLY

P-1 SHOPPING LIST

UNCLASSIFIED

EXHIBIT P-3A

U N C L A S S I F I E D

BMDO CONTROLLED RESOURCES									
BUDGET ITEM JUSTIFICATION SHEET								DATE: FEBRUARY 1994	
APPROPRIATION/BUDGET ACTIVITY PROCUREMENT, DEFENSEWIDE ACTIVITY 1				P1 ITEM NOMENCLATURE SEA BASED THEATER MISSILE DEFENSE (TMD) INITIATIVE					
	FY 1993	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999		
QUANTITY									
COST (\$M) TOTAL	0	0	14.496	11.287	49.265	150.225	143.392		
<p>Item Description/Justification</p> <p>This program provides support equipment , training equipment, and simulation capabilities for shore based facilities and for advance planning, design, cost, and feasibility studies and ship integration impact to support the introduction and integration of Theater Air Defense (TAD) capabilities in AEGIS cruiser (CG47) and destroyer (DDG51) class ships.</p> <p>The FY 95-99 funds will be used to upgrade four centers, the Combat System Engineering Development (CSED) site, the AEGIS Computer Center (ACC), the AEGIS Education Center (AEC), and the AEGIS Combat System Center (ACSC) to properly accommodate the CG47 and DDG51 combat system.</p>									

U N C L A S S I F I E D

U N C L A S S I F I E D

PROGRAM COST BREAKDOWN				(DOD EXHIBIT P-22)				A. FEBRUARY 1994				
B. APPROPRIATION/BUDGET ACTIVITY				C. P-1 ITEM NOMENCLATURE				SEA BASED THEATER MISSILE DEFENSE INITIATIVE				
PROCUREMENT, DEFENSEWIDE				ACTIVITY 1								
COST CODE	ELEMENT OF COST (1)	IDENT CODE (2)	TOTAL COST IN THOUSANDS OF DOLLARS									
			FY 1993		FY 1994		FY 1995					
			QTY (3)	TOTAL COST (4)	QTY (5)	TOTAL COST (6)	QTY (7)	TOTAL COST (8)	QTY (9)	TOTAL COST (10)		
BMD01	ADJUNCT PROCESSORS	A				0		0	2,071			
BMD02	AEGIS COMBAT SYS INTERFACE SIMULATOR UPGRADE	A				0		0	3,106			
BMD03	VLS ORDLATS	A				0		0	5,696			
BMD04	TRAINING SUPPORT EQUIPMENT	A				0		0	1,035			
BMD05	SITE EQUIPMENT	A				0		0	1,035			
BMD06	ADVANCED PLANNING	A				0		0	1,553			

U N C L A S S I F I E D

U N C L A S S I F I E D

BUDGET PROCUREMENT HISTORY AND PLANNING										A. DATE:	FEB 1994
B. APPROPRIATION/BUDGET ACTIVITY PROCUREMENT, DEFENSEWIDE			C. P-1 ITEM NOMENCLATURE SEA BASED THEATER MISSILE DEFENSE (TMD), INITIATIVE								
COST CODE	LINE ITEM/ FISCAL YEAR	CONTRACTOR AND LOCATION	CONTRACT METHOD & TYPE	CONTRACTED BY	AWARD DATE	DATE OF FIRST DELIVERY	QUANTITY	UNIT COST (\$000)	SPECS AVAILABLE NOW	SPEC REV REQ'D	IF YES, WHEN AVAILABLE
BMD01	ADJUNCT PROCESSOR FY 1995	TBD	CP/FF	NAVSEA	1/95	TBD	6	250	NO	NO	--
D. REMARKS											

U N C L A S S I F I E D

**BMDO MILCON SUMMARIES**

BALLISTIC MISSILE DEFENSE ORGANIZATION  
MILITARY CONSTRUCTION PROGRAM - FY 1995  
(APPROPRIATION REQUEST IN THOUSANDS OF DOLLARS)

PROGRAM BUDGET DECISION NO. 314

PLANNING AND DESIGN

<u>CATCODE</u>	<u>BASE/STATE/PROJECT</u>	<u>PROJECT TITLE</u>	<u>COST</u>
	VARIOUS LOCATIONS	PLANNING AND DESIGN	530
		<u>TOTAL:</u>	530

1. COMPONENT BMDO		FY 1995 MILITARY CONSTRUCTION PROJECT DATA			2. DATE 20 Sep 93	
3. INSTALLATION AND LOCATION VARIOUS LOCATIONS			4. PROJECT TITLE PLANNING AND DESIGN			
5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER BMDO 324		8. PROJECT COST (\$000) 530		
9. COST ESTIMATES						
ITEM		U/M	QUANTITY	UNIT COST	COST (\$000)	
		LS			530	
10. DESCRIPTION OF PROPOSED CONSTRUCTION: The funds requested will be used to provide financing for architectural and engineering services and for construction design of Ballistic Missile Defense Organization (BMDO) Military Construction projects.						
11. REQUIREMENT: As required (New Mission)						
<p><u>REQUIREMENT:</u> These planning and design funds are required to complete the design of facilities in the FY 1996 BMDO Military Construction program, initiate design of facilities in the FY 1997 BMDO Military Construction program, and accomplish planning and design for major and complex technical projects with a long lead-time to be included in subsequent BMDO Military Construction programs.</p>						



## OTHER EXHIBITS

OTHER EXHIBITS

1. EXHIBIT OP-8 (CIVILIAN PERSONNEL COSTS)
2. EXHIBIT PB-15 (CONSULTING SERVICES)
3. EXHIBIT PB-20 (PUBLIC AFFAIRS ACTIVITIES)
4. EXHIBIT PB-22 (MANAGEMENT HEADQUARTERS)
5. EXHIBIT PB-23 (LEGISLATIVE ACTIVITIES)
6. EXHIBIT PB-26 (FEDERALLY FUNDED RESEARCH & DEVELOPMENT CENTERS)
7. EXHIBIT 43 (INFORMATION TECHNOLOGY)
8. EXHIBIT 44A (RESEARCH & DEVELOPMENT ACTIVITIES)
9. EXHIBIT PB-52B (SPACE BUDGET)

[illegible]

	Full Time Equivalent		Full Time Equivalent		Workyears		Basic Comp	Overtime Pay	Hofiday Pay	Other OC-11	Total Variables	Total Comp OC-11	Benefits OC-12	Comp & Benefits
	Full Time Begin Strength	End Strength	Total	FTE	Total	FTE								
1. Direct Hire Civilian:														
a. U.S. Employees:														
(1) Classified and Administrative														
(a) Senior Executive Schedule	16.0	16.0	16.0	16.0	18.0	16.0	1,687.7					1,687.7	404.5	2,092.2
(b) General Merit Pay	84.0	156.0	156.0	156.0	156.0	156.0	10,547.0					10,547.0	2,528.1	13,075.1
(c) General Schedules	43.0	71.0	71.0	71.0	77.0	71.0	2,366.1					2,366.1	567.2	2,933.3
(d) Special Schedules														
Subtotal	143.0	243.0	243.0	243.0	251.0	243.0	14,600.8	65.0	0.1	785.0	850.1	15,450.9	3,499.8	18,950.7
(2) Wage Board														
(Rate)														
(3) Other IPA(s)					6.0		508.5							
(Rate)														
Subtotal United States	143.0	243.0	243.0	243.0	257.0	243.0	15,109.3	65.0	0.1	785.0	850.1	15,959.4	3,499.8	19,459.2
b. Direct Hire Foreign Nationals														
(Rate)														
c. Total Direct Hire														
(Rate)														
d. Disadvantaged Employment														
(Rate)														
2. Indirect Hire Foreign Nationals (INHI)														
(Rate)														
3. Foreign National Separation Liability Accrual														
a. Foreign Nationals Direct Hire														
b. Foreign Nationals Indirect Hire														
4. Benefits for Former Employees (OC-13)														
a. U.S. Direct Hire														
b. Foreign National Direct Hire														
5. TOTAL CIVILIAN PERSONNEL	143.0	243.0	243.0	243.0	257.0	243.0	15,109.3	65.0	0.1	785.0	850.1	15,959.4	3,499.8	19,459.2
(Rate)														
6. Reimbursable Data					2.0		160.0							
a. U.S. Direct Hires														
b. Foreign National Direct Hires														
c. Total Direct Hires														
d. Foreign Nationals Indirect Hire														
e. TOTAL REIMBURSABLE FUNDING														
7. DIRECT FUNDED CIVILIAN PERSONNEL	143.0	243.0	243.0	243.0	259.0	243.0	15,269.3	65.0	0.1	785.0	850.1	16,119.4	3,499.8	19,619.2
(Rate)														

DEPARTMENT OF DEFENSE  
BALLISTIC MISSILE DEFENSE ORGANIZATION  
CIVILIAN PERSONNEL COSTS  
Budget Submit/President's Budget  
FY 1995  
(\$ in Thousands)

	Full Time Equivalent		Full Time Equivalent End		Workyears		Basic Comp	Overtime Pay		Holidays Pay	Other OC-11	Total Variables	Total Comp OC-11	Benefits OC-12	Comp & Benefits
	Full Time Equivalent Begin Strength	Total	FTP	Strength	Total	FTP									
1 Direct Hire Civilian:															
a. U.S. Employees:															
(1) Classified and Administrative															
(a) Senior Executive Schedule	16.0	16.0	16.0	16.0	18.0	16.0	1,966.4						1,966.4	404.5	2,370.9
(b) General Merit Pay	156.0	228.0	228.0	228.0	228.0	228.0	16,062.5						16,062.5	3,621.3	19,683.8
(c) General Schedules	71.0	99.0	99.0	99.0	105.0	99.0	3,608.4						3,608.4	813.0	4,421.4
(d) Special Schedules															
Subtotal	243.0	343.0	343.0	343.0	351.0	343.0	21,637.3	65.0	0.1		1,561.5	1,626.6	23,263.9	4,838.8	28,102.7
(2) Wage Board															
(3) Other IPAs					6.0		508.5								
Subtotal United States	243.0	343.0	343.0	343.0	357.0	343.0	22,145.8	65.0	0.1		1,561.5	1,626.6	23,772.4	4,838.8	28,611.2
b. Direct Hire Foreign Nationals															
c. Total Direct Hire															
d. Disadvantaged Employment															
e. Indirect Hire Foreign Nationals (FNIH)															
f. Foreign National Separation Liability Accrual															
a. Foreign Nationals Direct Hire															
b. Foreign Nationals Indirect Hire															
Benefits for Former Employees (OC-13)															
a. U.S. Direct Hire															
b. Foreign National Direct Hire															
TOTAL CIVILIAN PERSONNEL	243.0	343.0	343.0	343.0	357.0	343.0	22,145.8	65.0	0.1		1,561.5	1,626.6	23,772.4	4,838.8	28,611.2
(Rate)															
6. Reimbursable Data															
a. U.S. Direct Hires					2.0		160.0								
b. Foreign National Direct Hires															
c. Total Direct Hires															
d. Foreign Nationals Indirect Hire															
e. TOTAL REIMBURSABLE FUNDING															
7. DIRECT FUNDED CIVILIAN PERSONNEL	243.0	343.0	343.0	343.0	359.0	343.0	22,305.8	65.0	0.1		1,561.5	1,626.6	23,932.4	4,838.8	28,771.2
(Rate)															

SCHEDULE OF CONSULTING SERVICES  
BALLISTIC MISSILE DEFENSE ORGANIZATION  
ALL EXECUTING AGENTS  
(ALL DOLLAR IN MILLIONS)

	<u>FY 1993</u>	<u>FY 1994</u>	<u>FY 1995</u>
I. MANAGEMNT & PROFEESIONAL SUPPORT SERVICES (2523)	101.912	98.072	97.238
II. STUDIES, ANALYSIS, & EVALUATIONS (2522)	66.488	51.542	55.093
III ENGINEERING & TECHNICAL SERVICES (2524)	<u>15.204</u>	<u>12.920</u>	<u>10.471</u>
TOTAL	183.604	162.534	162.802
			PB-15

1/11/94

BALLISTIC MISSILE DEFENSE ORGANIZATION  
EXTERNAL PUBLIC AFFAIRS ACTIVITIES  
FY 95 PRESIDENT'S BUDGET  
(\$ IN thousands)

	FY93			
	<u>ES</u>	<u>PROGRAM</u>	<u>PAY RAISE</u>	<u>TOTAL</u>
RDTE	1	82.7	2.4	85.1

	FY95			
	<u>ES</u>	<u>PROGRAM</u>	<u>PAY RAISE</u>	<u>TOTAL</u>
RDTE	2	154.9	4.6	159.5
			2.1	161.7

MILITARY ASSIGNED TO DEFENSE AGENCIES FROM THE SERVICES

	FY93		FY94		FY95	
	<u>ES</u>	<u>\$</u>	<u>ES</u>	<u>\$</u>	<u>ES</u>	<u>\$</u>
ARMY	1.5	133.0	1.5	140.0	1.5	142.2
USAF	<u>1.0</u>	<u>83.4</u>	<u>1.0</u>	<u>87.8</u>	<u>1.0</u>	<u>89.2</u>
TOTAL	2.5	216.4	2.5	227.8	2.5	231.4

BALLISTIC MISSILE DEFENSE ORGANIZATION  
EXTERNAL PUBLIC AFFAIRS ACTIVITIES  
FY95 PRESIDENT'S BUDGET

OBJECT CLASS DATA  
(\$ IN THOUSANDS)

	<u>FY93</u>	<u>FY94</u>	<u>FY95</u>
<u>RDTE</u>			
1100 PERMANENT POSITION	69.3	132.5	134.6
1200 PERSONAL BENEFITS	15.8	27.0	27.1
TOTAL RDTE	85.1	159.5	161.7
<u>MILPER</u>	<u>216.4</u>	<u>227.8</u>	<u>231.4</u>
Total PAO	301.5	387.3	393.1

END STRENGTH BY GRADE

	<u>FY93</u>	<u>FY94</u>	<u>FY95</u>
<u>CIVILIANS</u>			
GM14	1.0	1.0	1.0
GM12	0	1.0	1.0
<u>MIL PERSONNEL</u>			
O6	1.0	1.0	1.0
O4	1.0	1.0	1.0
E6	<u>.5</u>	<u>.5</u>	<u>.5</u>
TOTAL END STRENGTH	3.5	4.5	4.5



DEPARTMENT OF DEFENSE MANAGEMENT HEADQUARTERS

	FY 1992 Actual			FY 1993 Actuals			FY 1994 Estimate			FY 1995 Estimate		
	Military End Strength	Civilian End Strength	Total End Strength	Military End Strength	Civilian End Strength	Total End Strength	Military End Strength	Civilian End Strength	Total End Strength	Military End Strength	Civilian End Strength	Total End Strength
			Total Obligation (\$000)			Total Obligation (\$000)			Total Obligation (\$000)			Total Obligation (\$000)
Calendar/Operational/Amendment												
DEPARTMENT (0000)	104	139	247	35	74	109	39	210	249	39	190	238
			10,675.0			5,941.5			14,934.7			14,096.1

BALLISTIC MISSILE DEFENSE ORGANIZATION  
SUMMARY OF LEGISLATIVE ACTIVITIES-FISCAL YEAR 1993  
FY1995 PRESIDENT'S BUDGET  
(\$ IN THOUSANDS)

1 AV. NO CIV. EMPS	2 TOTAL CIV COMPENSATION	3 AV. NO MIL PERS	4 TOTAL MIL COST	5 ALL OTH COSTS	6 TOTAL COST
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A. LEGISLATIVE LIAISON  
NOT APPLICABLE

B. OTHER LEGISLATIVE ACTIVITIES

1. Personnel not included in Category A "Legislative Liaison" in the various components who spend at least 30 man days per year in direct personal contact with members and committees of the Congress and their staff.

PROGRAM	0	0	0	0	0
PAYRAISE	0	0	0	0	0
SUBTOTAL	0	0	0	0	0

2. Personnel involved with routine activities necessary for the preparation of a legislative program such as tracking legislation, writing analyses and performing research with respect to legislation.

PROGRAM	0	0	0	0	0
PAYRAISE	0	0	0	0	0
SUBTOTAL	0	0	0	0	0

3. Personnel not included above who spend more than 30 mandays per year in coordinating and answering congressional inquiries, constituent letters, and telephone inquiries.

PROGRAM	1.0	111.3	1.0	96.1	207.4
PAYRAISE		4.1		3.6	7.7
SUBTOTAL	1.0	115.4	1.0	99.7	215.1

4. Personnel not included above who spend more than 30 mandays per year in the preparation and the processing of congressional justification books, witness statements, and hearing transcripts.

PROGRAM	0.0	0.0	1.0	96.1	96.1
PAYRAISE				3.6	3.6
SUBTOTAL	0.0	0.0	1.0	99.7	99.7

BALLISTIC MISSILE DEFENSE ORGANIZATION  
SUMMARY OF LEGISLATIVE ACTIVITIES-FISCAL YEAR 1993  
FY1995 PRESIDENT'S BUDGET  
(\$ IN THOUSANDS)

5. All clerical and administrative personnel who spend at least 30 mandays per year assisting those personnel identified in category B.

PROGRAM	0.0	0.0	.5	19.6	0	19.6
PAYRAISE				.7	0	.7
SUBTOTAL	0.0	0.0	.5	20.3	0	203
TOTAL OTHER LEGISLATIVE ACITIVIES						
PROGRAM	1.0	111.3	2.5	211.8	0	323.1
PAYRAISE		4.1		7.9	0	12.0
SUBTOTAL	1.0	115.4	2.5	219.7	0	335.1
GRAND TOTAL	1.0	115.4	2.5	219.7	0	335.1

PAYRAISE 3.7%

BALLISTIC MISSILE DEFENSE ORGANIZATION  
SUMMARY OF LEGISLATIVE ACTIVITIES-FISCAL YEAR 1994  
FY1995 PRESIDENT'S BUDGET  
(\$ IN THOUSANDS)

1 AV. NO CIV. EMPS	2 TOTAL CIV COMPENSATION	3 AV. NO MIL PERS	4 TOTAL MIL COST	5 ALL OTH COSTS	6 TOTAL COST
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A. LEGISLATIVE LIAISON  
NOT APPLICABLE

B. OTHER LEGISLATIVE ACTIVITIES

1. Personnel not included in Category A "Legislative Liaison" in the various components who spend at least 30 man days per year in direct personal contact with members and committees of the Congress and their staff.

PROGRAM	0	0	0	0	0
PAYRAISE	0	0	0	0	0
SUBTOTAL	0	0	0	0	0

2. Personnel involved with routine activities necessary for the preparation of a legislative program such as tracking legislation, writing analyses and performing research with respect to legislation.

PROGRAM	0	0	0	0	0
PAYRAISE	0	0	0	0	0
SUBTOTAL	0	0	0	0	0

3. Personnel not included above who spend more than 30 mandays per year in coordinating and answering congressional inquiries, constituent letters, and telephone inquiries.

PROGRAM	1.0	115.4	1.0	94.2	209.6
PAYRAISE		4.3		3.5	7.8
SUBTOTAL	1.0	119.7	1.0	97.7	217.4

4. Personnel not included above who spend more than 30 mandays per year in the preparation and the processing of congressional justification books, witness statements, and hearing transcripts.

PROGRAM	0.0	0.0	1.0	94.2	94.2
PAYRAISE				3.5	3.5
SUBTOTAL	0.0	0.0	1.0	97.7	97.7

BALLISTIC MISSILE DEFENSE ORGANIZATION  
SUMMARY OF LEGISLATIVE ACTIVITIES-FISCAL YEAR 1994  
FY1995 PRESIDENT'S BUDGET  
(\$ IN THOUSANDS)

5. All clerical and administrative personnel who spend at least 30 mandays per year assisting those personnel identified in category B.						
PROGRAM	0.0	0.0	.5	19.6	0	19.6
PAYRAISE				.7	0	.7
SUBTOTAL	0.0	0.0	.5	20.3	0	20.3
TOTAL OTHER LEGISLATIVE ACITIVIES						
PROGRAM	1.0	115.4	2.5	208.0	0	323.4
PAYRAISE		4.3		7.7	0	12.0
SUBTOTAL	1.0	119.7	2.5	215.7	0	335.4
GRAND TOTAL	1.0	119.7	2.5	215.7	0	335.4

PAYRAISE 3.6%(LOCALITY PAY)

BALLISTIC MISSILE DEFENSE ORGANIZATION  
SUMMARY OF LEGISLATIVE ACTIVITIES-FISCAL YEAR 1995  
FY1995 PRESIDENT'S BUDGET  
(\$ IN THOUSANDS)

1	2	3	4	5	6
AV. NO CIV. EMPS	TOTAL CIV COMPENSATION	AV. NO MIL PERS	TOTAL MIL COST	ALL OTH COSTS	TOTAL COST
<u>A. LEGISLATIVE LIAISON</u>					
NOT APPLICABLE					
<u>B. OTHER LEGISLATIVE ACTIVITIES</u>					
1. Personnel not included in Category A "Legislative Liaison" in the various components who spend at least 30 man days per year in direct personal contact with members and committees of the Congress and their staff.					
PROGRAM	0	0	0	0	0
PAYRAISE	0	0	0	0	0
SUBTOTAL	0	0	0	0	0
2. Personnel involved with routine activities necessary for the preparation of a legislative program such as tracking legislation, writing analyses and performing research with respect to legislation.					
PROGRAM	0	0	0	0	0
PAYRAISE	0	0	0	0	0
SUBTOTAL	0	0	0	0	0
3. Personnel not included above who spend more than 30 mandays per year in coordinating and answering congressional inquiries, constituent letters, and telephone inquiries.					
PROGRAM	1.0	1.0	97.7	0	217.4
PAYRAISE			1.6	0	3.5
SUBTOTAL	1.0	1.0	99.3	0	230.9
4. Personnel not included above who spend more than 30 mandays per year in the preparation and the processing of congressional justification books, witness statements, and hearing transcripts.					
PROGRAM	0.0	1.0	97.7	0	97.7
PAYRAISE			1.6	0	1.6
SUBTOTAL	0.0	1.0	99.3	0	99.3

BALLISTIC MISSILE DEFENSE ORGANIZATION  
SUMMARY OF LEGISLATIVE ACTIVITIES-FISCAL YEAR 1995  
FY1995 PRESIDENT'S BUDGET  
(\$ IN THOUSANDS)

5. All clerical and administrative personnel who spend at least 30 mandays per year assisting those personnel identified in category B.						
PROGRAM	0.0	0.0	.5	20.3	0	20.3
PAYRAISE				.3	0	.3
SUBTOTAL	0.0	0.0	.5	20.6	0	20.6
TOTAL OTHER LEGISLATIVE ACITIVIES						
PROGRAM	1.0	119.7	2.5	215.7	0	335.4
PAYRAISE		1.9		3.5	0	5.4
SUBTOTAL	1.0	121.6	2.5	219.2	0	340.8
GRAND TOTAL	1.0	121.6	2.5	219.2	0	340.8

PAYRAISE 1.6%

01/11/94

BALLISTIC MISSILE DEFENSE ORGANIZATION  
FEDERALLY FUNDED RESEARCH DEVELOPMENT CENTER RESOURCES  
(\$ IN MILLIONS)

SPONSOR	PE	FY93	FY94	FY95
** FFRDC ARGONNE NATL LAB				
DOE	0603217C	4.285	0.253	0.291
DOE	0603218C	0.000	1.775	0.000
** Subtotal **		4.285	2.028	0.291
** FFRDC AEROSPACE CORP				
USAF	0603214C	5.970	0.000	0.000
USAF	0603215C	21.988	1.862	11.560
USAF	0603216C	0.500	3.631	2.687
USAF	0603218C	3.042	1.515	0.100
** Subtotal **		31.500	7.008	14.347
** FFRDC C3I (MITRE)				
OSD	0603215C	13.536	7.283	19.271
OSD	0603216C	1.096	0.923	1.094
OSD	0603218C	1.500	1.083	1.250
** Subtotal **		16.132	9.289	21.615
** FFRDC IDA				
OSD	0603215C	2.250	1.589	1.833
OSD	0603218C	3.650	2.636	3.042
** Subtotal **		5.900	4.225	4.875
** FFRDC JET PROPULSION LAB				
NASA	0603215C	10.862	2.434	2.809
NASA	0603217C	2.340	0.433	0.500
NASA	0603218C	8.447	6.512	7.435
** Subtotal **		21.649	9.379	10.744
** FFRDC LAWRENCE LIVERMORE				
DOE	0603214C	12.600	0.000	0.000
DOE	0603215C	21.963	0.844	1.467
DOE	0603216C	28.445	1.040	0.742
DOE	0603217C	20.108	0.000	0.000
DOE	0603218C	3.050	26.345	33.518
** Subtotal **		86.166	28.229	35.727



BALLISTIC MISSILE DEFENSE ORGANIZATION  
FEDERALLY FUNDED RESEARCH DEVELOPMENT CENTER RESOURCES  
(\$ IN MILLIONS)

SPONSOR	PE	FY93	FY94	FY95
** FFRDC LINCOLN LAB(MIT)				
USAF	0603214C	0.050	0.036	0.042
USAF	0603215C	42.998	15.217	14.085
USAF	0603216C	14.414	9.595	22.110
USAF	0603217C	1.700	1.084	1.250
USAF	0603218C	7.211	5.243	5.288
** Subtotal **		66.373	31.175	42.775
** FFRDC LOGISTIC MGMT INST				
OSD	0603215C	0.280	0.202	0.233
OSD	0603218C	0.320	0.231	0.267
** Subtotal **		0.600	0.433	0.500
** FFRDC LOS ALAMOS NTL LAB				
DOE	0603215C	3.080	0.539	1.272
DOE	0603216C	0.151	0.555	0.305
DOE	0603217C	28.160	0.072	0.083
DOE	0603218C	7.163	3.473	0.360
** Subtotal **		38.554	4.639	2.020
** FFRDC NTL DEF RSCH INST(RAND)				
OSD	0603215C	0.830	0.600	0.692
OSD	0603218C	0.320	0.231	0.266
** Subtotal **		1.150	0.831	0.958
** FFRDC SANDIA NATL LAB				
DOE	0603214C	0.005	0.004	0.005
DOE	0603215C	67.098	18.167	26.315
DOE	0603216C	0.904	2.150	1.027
DOE	0603217C	0.475	0.000	0.000
DOE	0603218C	10.247	5.736	1.742
** Subtotal **		78.729	26.057	29.089

BALLISTIC MISSILE DEFENSE ORGANIZATION  
FEDERALLY FUNDED RESEARCH DEVELOPMENT CENTER RESOURCES  
(\$ IN MILLIONS)

SPONSOR	PE	FY93	FY94	FY95
** FFRDC OAKRIDGE NATL LAB				
DOE	0603215C	0.398	0.100	0.000
DOE	0603218C	0.700	0.000	0.000
** Subtotal **		1.098	0.100	0.000
** FFRDC HANFORD NATL LAB				
DOE	0603217C	0.150	0.000	0.000
DOE	0603218C	0.000	0.075	0.000
** Subtotal **		0.150	0.075	0.000
** FFRDC LAWRENCE BERKLEY LAB				
DOE	0603217C	0.660	0.000	0.000
DOE	0603218C	0.000	0.195	0.000
** Subtotal **		0.660	0.195	0.000
** FFRDC BROOKHAVEN NATL LAB				
DOE	0603217C	0.010	0.000	0.000
** Subtotal **		0.010	0.000	0.000
** FFRDC CENTER FOR NAVAL ANALYSIS				
USN	0603216C	1.800	0.000	0.000
** Subtotal **		1.800	0.000	0.000
*** Total ***		354.756	123.663	162.941

**EXHIBIT 43 (INFORMATION TECHNOLOGY)**

**EXHIBITS TO BE PROVIDED**

**AT A LATER DATE**

December 29, 1993  
EX44A

RESEARCH AND DEVELOPMENT ACTIVITIES  
BALLASTIC MISSILE DEFENSE ORGANIZATION  
(\$ IN MILLIONS )

Conduct of R&D by Activity		FY1993	FY1994	FY1995
Basic Research	N/A			
Applied Research	BA	0.0	0.0	106.4
	Outlays	0.0	0.0	101.1
Total RDT&E	BA	3628.3	2617.2	2985.2
	Outlays	3468.5	2486.3	2836.0
Facilities included in R&D	BA	1.1	2.0	2.0
	Outlays	.6	1.7	1.7
R&D by Colleges & Univs	BA	140.6	125.7	128.0
	Outlays	139.0	124.0	127.0
Facilities included in MILCON	BA	2.5	2.7	.5
	Outlays	7.1	3.5	2.0
Indirect Costs related to R&D performed by Coll & Univs	BA	0	0	0
	Outlays	0	0	0

**DoD Space Budget**  
**President's Aeronautical and Space Report and the National Space Council Annual Report**  
**Ballistic Missile Defense Organization (BMDO)**  
**(\$ in Thousands)**

**Appropriation Summary:**  
**RDT&E,DA**

**FY92** **FY93** **FY94** **FY95** **FY96** **FY97** **FY98** **FY99**

1,152,250 917,129 297,531 348,200 378,400 367,700 403,000 382,500

**Program Data**

Program #	Program Title	Prog Element	Appn Code	Factor	Category	FY92	FY93	FY94	FY95	FY96	FY97	FY98	FY99
1101	Passive Sensors	0603214C	RDT&E,DA	100%	MISS. DEF	9,000	0	0	0	0	0	0	0
1104	Signal Processing	0603214C	RDT&E,DA	100%	MISS. DEF	2,200	0	0	0	0	0	0	0
1501	Survivability	0603214C	RDT&E,DA	100%	MISS. DEF	4,700	0	0	0	0	0	0	0
1502	Leth & Tgt Hard	0603214C	RDT&E,DA	100%	MISS. DEF	5,600	4,000	0	0	0	0	0	0
1504	Mails & Structure	0603214C	RDT&E,DA	100%	MISS. DEF	2,766	0	0	0	0	0	0	0
2205	BP	0603214C	RDT&E,DA	100%	MISS. DEF	383,495	207,279	0	0	0	0	0	0
3304	Targets	0603214C	RDT&E,DA	100%	MISS. DEF	6,693	0	0	0	0	0	0	0
4000	Operational Support	0603214C	RDT&E,DA	100%	MISS. DEF	18,195	0	0	0	0	0	0	0
1101	Passive Sensors	0603215C	RDT&E,DA	100%	MISS. DEF	25,703	20,357	9,822	0	0	0	0	0
1104	Signal Processing	0603215C	RDT&E,DA	100%	MISS. DEF	28,355	18,410	6,914	0	0	0	0	0
1106	Sens Stud & Exp	0603215C	RDT&E,DA	100%	MISS. DEF	165,058	149,984	86,311	0	0	0	0	0
1110	Sensor Integration	0603215C	RDT&E,DA	100%	MISS. DEF	20,900	53,370	0	0	0	0	0	0
1403	Computer Eng Tech	0603215C	RDT&E,DA	100%	MISS. DEF	704	2,630	0	0	0	0	0	0
1405	Communications Eng Tech	0603215C	RDT&E,DA	100%	MISS. DEF	10,322	12,205	1,932	0	0	0	0	0
1701	Launch Services	0603215C	RDT&E,DA	100%	LAUNCH	0	30,118	0	0	0	0	0	0
2102	BE	0603215C	RDT&E,DA	100%	SURVEIL	73,793	209,900	0	0	0	0	0	0
1101	Passive Sensors	0603217C	RDT&E,DA	100%	MISS. DEF	0	0	0	24,500	26,600	25,500	12,900	12,500
1104	Signal Processing	0603217C	RDT&E,DA	100%	MISS. DEF	0	0	0	7,100	12,000	13,500	7,000	5,000
1106	Sens Stud & Exp	0603217C	RDT&E,DA	100%	MISS. DEF	0	0	0	48,600	40,800	32,500	37,100	20,000
1110	Sensor Integration	0603217C	RDT&E,DA	100%	MISS. DEF	500	0	0	0	0	0	0	0
1111	Advanced Sensor Tech	0603217C	RDT&E,DA	100%	MISS. DEF	0	0	0	48,000	48,000	48,000	48,000	48,000
1202	Interceptor Integ	0603217C	RDT&E,DA	100%	MISS. DEF	46,535	43,989	0	0	0	0	0	0
1302	Chem Laser Tech	0603217C	RDT&E,DA	100%	MISS. DEF	99,158	69,164	0	77,500	77,500	77,500	77,500	77,500
1303	Neutral Part Beam	0603217C	RDT&E,DA	100%	MISS. DEF	75,020	39,126	0	0	0	0	0	0
1305	ATP/FC Tech	0603217C	RDT&E,DA	100%	MISS. DEF	60,106	21,067	0	12,500	12,500	12,500	12,500	12,500
1403	Computer Eng Tech	0603217C	RDT&E,DA	100%	MISS. DEF	0	0	0	2,500	0	0	0	0
1405	Communications Eng Tech	0603217C	RDT&E,DA	100%	MISS. DEF	0	0	0	500	0	0	0	0
1504	Mails & Structure	0603217C	RDT&E,DA	100%	MISS. DEF	24,705	2,600	0	7,000	11,000	8,200	8,000	7,000
1701	Launch Services	0603217C	RDT&E,DA	100%	LAUNCH	57,661	0	0	0	0	0	0	0
1702	Spec Test Act	0603217C	RDT&E,DA	100%	LAUNCH	31,081	32,930	0	0	0	0	0	0
1110	Sensor Integration	0603218C	RDT&E,DA	100%	MISS. DEF	0	0	25,306	0	0	0	0	0
1202	Interceptor Integ	0603218C	RDT&E,DA	100%	MISS. DEF	0	0	36,527	0	0	0	0	0
1214	Adv Intercept Tech	0603218C	RDT&E,DA	100%	MISS. DEF	0	0	15,000	0	0	0	0	0
1302	Chem Laser Tech	0603218C	RDT&E,DA	100%	MISS. DEF	0	0	54,269	0	0	0	0	0
1303	Neutral Part Beam	0603218C	RDT&E,DA	100%	MISS. DEF	0	0	7,392	0	0	0	0	0
1305	ATP/FC Tech	0603218C	RDT&E,DA	100%	MISS. DEF	0	0	6,492	0	0	0	0	0
1504	Mails & Structure	0603218C	RDT&E,DA	100%	MISS. DEF	0	0	4,570	0	0	0	0	0
1701	Launch Services	0603218C	RDT&E,DA	100%	LAUNCH	0	0	38,112	0	0	0	0	0
1702	Spec Test Act	0603218C	RDT&E,DA	100%	LAUNCH	0	0	4,884	0	0	0	0	0
2102	BE	0604217C	RDT&E,DA	100%	SURVEIL	0	0	0	120,000	150,000	150,000	200,000	200,000

**POINT OF CONTACT LIST**

CONGRESSIONAL DESCRIPTIVE SUMMARY (CDS)  
POINT OF CONTACT (POC) LIST

<u>CDS REPORTED</u>	<u>PROJECT TITLE</u> (PROGRAM) (ELEMENT)	<u>PROJECT INTEGRATOR</u>	<u>OFC SYM</u>	<u>PHONE NO.</u>	<u>ROOM NO.</u>
1101	Passive Sensors (0603217C RDT&E)	Mr Erwin Myrick	DTS	58842	1E168
1102	Radar (0603217C RDT&E)	MAJ Kevin House	DTS	56862	1E130
1104	Signal Processing (0603217C RDT&E)	Capt Scott Larrimore	DTS	58825	1E168
1105	Discrimination (0603216C RDT&E) (0603217C RDT&E) (0603217C MILCON)	Capt Lynn Lodi	DTS	56862	1E130
1106	Sens Stud & Exp (0603216C RDT&E) (0603217C RDT&E)	Dr W Frederick	DTS	58832	1E168
1110	Sensor Integration (0603217C RDT&E)	Lt Col Pete Rustan	DTI	31671	1E167
1111	Adv Sensor Tech (0603217C RDT&E)	Capt Scott Larrimore	DTS	58825	1E168
1201	Int Comp Tech (0603216C RDT&E) (0603217C RDT&E)	MAJ Earl Hill	DTC	58825	1E168
1202	Interceptor Int (0603217C RDT&E)	Mr Richard Matlock	DTC	74017	1E168
1204	Interceptor Stud & Anal (0603217C RDT&E)	MAJ Earl Hill	DTC	58825	1E168
1206	Advanced Tmd Weapons (0603216C RDT&E)	LTC Juan Jimenez	GTW	31781	1E1020
1208	Discriminating Int (0603217C RDT&E)	Dr Walter Dyer	DTC	58846	1E168
1209	Endo Tech (0603217C RDT&E)	MAJ Earl Hill	DTC	58825	1E168
1212	D-2 Program (0603217C RDT&E)	Dr Walter Dyer	DTC	58846	1E168

CONGRESSIONAL DESCRIPTIVE SUMMARY (CDS)  
POINT OF CONTACT (POC) LIST

<u>CDS REPORTED</u>	<u>PROJECT TITLE</u> (PROGRAM) (ELEMENT)	<u>PROJECT INTEGRATOR</u>	<u>OFC SYM</u>	<u>PHONE NO.</u>	<u>ROOM NO.</u>
1214	Adv Interceptor Tech (0603217C RDT&E)	Keith Englander	GSG	31600	1E149
1215	Boost Phase Int / EXO (0603216C RDT&E) (0603217C RDT&E)	Lt Col Dale Tietz	DTD	31568	1E178
1216	Sea-Based Wide Area (0603216C RDT&E)	CDR Carey	GTI	31781	1E1020
1217	KKV Technology (0603217C RDT&E)	LTC Robert MacMullin	GSN	31600	1E149
1301	Radio Frequency FEL (0603217C RDT&E)	Mr Daniel Wildt	DTD	31568	1E178
1302	Chem Laser (0603217C RDT&E)	Mr Daniel Wildt	DTD	31568	1E178
1303	NPB Tech (0603217C RDT&E)	Mr Daniel Wildt	DTD	31568	1E178
1305	ATP/FC Tech (0603217C RDT&E)	Col Tom Humpherys	DTD	31568	1E178
1307	DEW Demo (0603217C RDT&E)	Mr Neil Griff	DTD	31568	1E178
1403	Computer Eng Tech (0603217C RDT&E)	Capt Scott Larrimore	DTS	58825	1E168
1405	Communications Eng Tech (0603217C RDT&E)	Mr Walter Dyer	DTC	58843	1E168
1501	Survivability (0603216C RDT&E) (0603217C RDT&E)	Maj Garrett Schneider	DTS	31665	1E180
1502	Leth & Tgt Hard (0603216C RDT&E) (0603217C RDT&E)	Lt Col Chuck Martin	DTC	31801	1E168
1503	Power & Power Condit (0603217C RDT&E)	LTC Fred Tarantino	DT	31671	1E152



CONGRESSIONAL DESCRIPTIVE SUMMARY (CDS)  
POINT OF CONTACT (POC) LIST

<u>CDS REPORTED</u>	<u>PROJECT TITLE</u> (PROGRAM) (ELEMENT)	<u>PROJECT INTEGRATOR</u>	<u>OFC SYM</u>	<u>PHONE NO.</u>	<u>ROOM NO.</u>
1504	Matls & Structure (0603216C RDT&E) (0603217C RDT&E)	Lt Col Michael Obal	DTI	31663	1E167
1601	IS&T (0602217C RDT&E)	Dr Dwight Duston	DTI	31673	1E167
1602	SBIR (0602217C RDT&E)	Mr Carl Nelson	DTI	59695	1E167
1700	Flight Tst / Launch Act (0603217C RDT&E)	Lt Col Mike Baker	DTC	31676	1E180
2102	BE (0604217C RDT&E)	Lt Col David Svetz	GSN	31600	1E149
2103	GSTS (0603217C RDT&E)	Lt Col David Svetz	GSN	31600	1E149
2104	GBR (0208060C PROC) (0603217C RDT&E) (0604216C RDT&E) (0604225C RDT&E)	LtCol Blume	GTW	31086	1E1020
2207	Patriot (0208060C PROC) (0604216C RDT&E) (0604225C RDT&E)	LTC Andrew Fallon	GTW	31086	1E1020
2208	ERINT (0604216C RDT&E)	COL Ernest Bubb	GTW	31086	1E1020
2209	ARROW/ACES (0603216C RDT&E)	Col Jeanne Sutton	GTW	31808	1E1020
2210	THAAD (0208060C PROC) (0604216C RDT&E) (0604225C RDT&E)	MAJ Patrick O Reilly	GTW	31782	1E1020
2212	Corps SAM (0603216C RDT&E)	LTC (P) Perry Casto	GTW	31783	1E1020

CONGRESSIONAL DESCRIPTIVE SUMMARY (CDS)  
POINT OF CONTACT (POC) LIST

<u>CDS REPORTED</u>	<u>PROJECT TITLE</u> (PROGRAM) (ELEMENT)	<u>PROJECT INTEGRATOR</u>	<u>OFC SYM</u>	<u>PHONE NO.</u>	<u>ROOM NO.</u>
2213	Sea Based TMD Int (0208060C PROC) (0603216C RDT&E) (0604216C RDT&E) (0604225C RDT&E)	CDR John Carey	GTI	31781	1E1020
2215	Adv Capbl Dem/Val Prg (0604216C RDT&E)	Col Gordon Hagewood	GTP	31513	1E1044
2300	BM/C3 Technology (0603216C RDT&E) (0603217C RDT&E)	Col William Criss	GSS	31594	1E149
2308	HAWK System BM/C3 (0208060C PROC) (0604216C RDT&E)	LTC John Upton	GTS	31784	1E1044
3101	Engr/Integration Suppt (0603216C RDT&E) (0603217C RDT&E)	Col James R, Lingvai	GSi	31608	1E149
3107	Envir Siting & Facil (0603217C RDT&E) (0603217C MILCON)	Mr Michael Aimone	GST	31743	1E180
3201	Architecture & Studies (0603216C RDT&E) (0603217C RDT&E)	Lt Col Hal Hagemeier	DRP	58742	1E1008
3202	Operations Interface (0603216C RDT&E) (0603217C RDT&E)	COL Howard Withycombe	GAQ	31838	1E149
3203	Intel Threat Dev (0603217C RDT&E)	CAPT Paul Tilson	DSI	36690	1E1062
3204	Countermeasures Integ (0603217C RDT&E)	Col Robert Swedenburg	DSI	36691	1E1062
3206	System Threat (0603217C RDT&E)	Mr Robert Kranc	DSI	73529	1E1062

CONGRESSIONAL DESCRIPTIVE SUMMARY (CDS)  
POINT OF CONTACT (POC) LIST

<u>CDS REPORTED</u>	<u>PROJECT TITLE</u> (PROGRAM) (ELEMENT)	<u>PROJECT INTEGRATOR</u>	<u>OFC SYM</u>	<u>PHONE NO.</u>	<u>ROOM NO.</u>
3211	C4I & Concepts Ops Anal (0208060C PROC) (0604216C RDT&E) (0604225C RDT&E)	Maj Rene Ramirez	GTI	36634	1E1044
3300	Test & Eval Support (0603216C RDT&E) (0603217C RDT&E) (0603218C RDT&E) (0604216C RDT&E)	COL Michael Toole	GST	31578	1E180
4000	Operational Support (0603216C RDT&E) (0603217C RDT&E) (0603218C RDT&E)	Mr Don Koval	DPF	31638	1E1037
4302	Technology Transfer (0603217C RDT&E)	Mr Nick Montanarelli	DTI	31671	1E167
4305	Min Acc for PET (0603217C RDT&E)	Mr Nick Montanarelli	DTI	31671	1E167